BS EN 15804:2012+A2:2019
Incorporating corrigenda February 2014, July 2020 and August 2021

BSI Standards Publication

Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

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National foreword

This British Standard is the UK implementation of EN 15804:2012+A2:2019, incorporating corrigendum August 2021. It supersedes BS EN 15804:2012+A1:2013, which will be withdrawn on 31 October 2022.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1⟩ ⟨A1].

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CEN corrigendum August 2021 is indicated in the text by [AC⟩ ⟨AC].

The UK participation in its preparation was entrusted to Technical Committee B/558, Sustainability of construction works.

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

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Published by BSI Standards Limited 2021

ISBN 978 0 539 19042 7

ICS 91.010.99

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 February 2012.

Amendments/corrigenda issued since publication

Date	Text affected
28 February 2014	Implementation of CEN correction notice 29 January 2014: Table C.5 and A1 amendment text
30 November 2019	Implementation of CEN amendment A2:2019

Date	Text affected
31 July 2020	Correction to supersession details in national foreword
30 September 2021	Implementation of CEN corrigendum August 2021

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15804:2012+A2

October 2019

ICS 91.010.99

Supersedes EN 15804:2012+A1:2013

English Version

Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

Contribution des ouvrages de construction au développement durable - Déclarations environnementales sur les produits - Règles régissant les catégories de produits de construction

Nachhaltigkeit von Bauwerken - Umweltproduktdeklarationen - Grundregeln für die Produktkategorie Bauprodukte

This European Standard was approved by CEN on 10 September 2013 and includes Amendment 2 approved by CEN on 21 July 2019.

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Ref. No. EN 15804:2012+A2:2019 E

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European foreword

This document (EN 15804:2012+A2:2019) has been prepared by Technical Committee CEN/TC 350 "Sustainability of construction works", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2020, and conflicting national standards shall be withdrawn at the latest by October 2022.

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

This document supersedes [A2] EN 15804:2012+A1:2013 [/A2].

This document includes Amendment 1 approved by CEN on 2013-09-10 and Amendment 2 approved by CEN on 2019-07-21.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [/A1] and [A2] [/A2].

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

Introduction

This European standard provides core product category rules for all construction products and services. It provides a structure to ensure that all Environmental Product Declarations (EPD) of construction products, construction services and construction processes are derived, verified and presented in a harmonised way.

An EPD communicates verifiable, accurate, non-misleading environmental information for products and their applications, thereby supporting scientifically based, fair choices and stimulating the potential for market-driven continuous environmental improvement.

The standardisation process has taken place in accordance with EN ISO 14025. All common issues are covered horizontally for all product types in order to minimise vertical (branch specific) deviations.

EPD information is expressed in information modules, which allow easy organisation and expression of data packages throughout the life cycle of the product. The approach requires that the underlying data should be consistent, reproducible and comparable.

The EPD is expressed in a form that allows aggregation (addition) to provide complete [A2] information for buildings and other construction works [A2]. This standard does not deal with aggregation at the building level nor does this standard describe the rules for applying EPD in a building assessment.

[A2] The standard deals with a set of quantifiable, predetermined environmental impact indicators. This standard has been adapted to address the amendment of the standardization Mandate M/350. [A2]

This European Standard provides the means for developing a Type III environmental declaration of construction products and is part of a suite of standards that are intended to assess the sustainability of construction works.

[A2] *deleted text* [A2]

— EN 15643-1, *Sustainability of construction works —Sustainability assessment of buildings — Part 1: General framework*;

— EN 15643-2, *Sustainability of construction works — Assessment of buildings — Part 2: Framework for the assessment of environmental performance*;

— EN 15978, *Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method*;

— CEN/TR 15941, *Sustainability of construction works — Environmental product declarations — Methodology for selection and use of generic data*;

— EN 15942, *Sustainability of construction works — Environmental product declarations — Communication formats: business to business*.

1 Scope

This European standard provides core product category rules (PCR) for Type III environmental declarations for any construction product and construction service.

NOTE The assessment of social and economic performances at product level is not covered by this standard.

The core PCR:

— [A2] defines the indicators to be declared, information to be provided and the way in which they are collated and reported, [/A2]

— describes which stages of a product's life cycle are considered in the EPD and which processes are to be included in the life cycle stages,

— defines rules for the development of scenarios,

— includes the rules for calculating the Life Cycle Inventory and the Life Cycle Impact Assessment underlying the EPD, including the specification of the data quality to be applied,

— includes the rules for reporting predetermined, environmental and health information, that is not covered by LCA for a product, construction process and construction service where necessary,

— defines the conditions under which construction products can be compared based on the information provided by EPD.

For the EPD of construction services the same rules and requirements apply as for the EPD of construction products.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TR 15941, *Sustainability of construction works — Environmental product declarations — Methodology for selection and use of generic data*

EN 15942, *Sustainability of construction works — Environmental product declarations — Communication formats: business to business*

EN 15978, *Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method*

EN ISO 14025:2010, *Environmental labels and declarations — Type III environmental declarations — Principles and procedures (ISO 14025:2006)*

EN ISO 14044:2006, *Environmental management — Life cycle assessment — Requirements and guidelines (ISO 14044:2006)*

[A2] EN ISO 14067:2018, *Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification (ISO 14067:2018)* [/A2]

ISO 15686-1, *Buildings and constructed assets — Service life planning — Part 1: General principles and framework*

ISO 15686-2, *Buildings and constructed assets — Service life planning — Part 2: Service life prediction procedures*

ISO 15686-7, *Buildings and constructed assets — Service life planning — Part 7: Performance evaluation for feedback of service life data from practice*

ISO 15686-8:2008, *Buildings and constructed assets — Service-life planning — Part 8: Reference service life and service-life estimation*

[A2] ISO 21930:2017, *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services* [A2]

[A2] European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - Nomenclature and other conventions. 2010. EUR 24384 EN. Luxembourg. Publications Office of the European Union; 2010, ISBN 978-92-79-15861-2

Suggestions for updating the Product Environmental Footprint (PEF) method, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-00654-1, doi:10.2760/424613, JRC11595[1)] [A2]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
additional technical information
information that forms part of the EPD by providing a basis for the development of scenarios

3.2
ancillary material
input material or product that is used by the unit process producing the product, but which does not constitute part of the product

[EN ISO 14040:2006]

[A2] **3.3**
average data
data representative of a product, product group or construction service, provided by one or more suppliers

Note 1 to entry: The product group or construction service can contain similar products or construction services. [A2]

1) This document is also called "PEF Guidance Document".

3.4
comparative assertion
environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function

[EN ISO 14044:2006]

3.5
complementary product category rules
c-PCR
product group specific or horizontal PCR, which provide additional compliant and non-contradictory requirements to EN 15804

Note 1 to entry: c-PCR are meant to be used together with EN 15804.

[SOURCE: CEN/TR 16970:2016]

3.6
construction product
item manufactured or processed for incorporation in construction works

Note 1 to entry: Construction products are items supplied by a single responsible body.

Note 2 to entry: Adapted from the definition in ISO 6707-1:2004 according to the recommendation of ISO/TC 59/AHG Terminology.

[EN 15643-1:2010]

3.7
construction service
activity that supports the construction process or subsequent maintenance

3.8
co-product
any of two or more marketable materials, products or fuels from the same unit process, but which is not the object of the assessment

Note 1 to entry: Co-product, by-product and product have the same status and are used for identification of several distinguished flows of products from the same unit process. From co-product, by-product and product, waste is the only output to be distinguished as a non-product.

3.9
declared unit
quantity of a construction product for use as a reference unit in an EPD for an environmental declaration based on one or more information modules

EXAMPLE Mass (kg), volume (m^3).

Note 1 to entry: Adapted from the definition in ISO 21930:2017.

3.10
construction element
part of a construction containing a defined combination of products

3.11
environmental performance
performance related to environmental impacts and environmental aspects

[ISO 15392:2008]

[ISO 21931-1:2010]

3.12
functional equivalent
quantified functional requirements and/or technical requirements for a building or an assembled system (part of works) for use as a basis for comparison

Note 1 to entry: Adapted from the definition in ISO 21931-1:2010.

3.13
functional unit
quantified performance of a product system for use as a reference unit

[EN ISO 14040:2006]

3.14
information module
compilation of data to be used as a basis for a Type III environmental declaration covering a unit process or a combination of unit processes that are part of the life cycle of a product

[EN ISO 14025:2010]

3.15
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[EN ISO 14044:2006]

3.16
life cycle inventory analysis
LCI
phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle

[EN ISO 14040:2006]

3.17
non-renewable energy
energy from sources which are not defined as *renewable energy* sources

3.18
non-renewable resource
resource that exists in a finite amount that cannot be replenished on a human time scale

deleted text

3.19
performance
expression relating to the magnitude of a particular aspect of the object of consideration relative to specified requirements, objectives or targets

Note 1 to entry: Adapted from the definition in ISO 6707-1:2004 according to the draft recommendation of ISO/TC 59 Terminology.

3.20
product category
group of construction products that can fulfil equivalent functions

Note 1 to entry: Adapted from EN ISO 14025:2010.

3.21
product category rules
PCR
set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories

[EN ISO 14025:2010]

3.22
product system
collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product

[EN ISO 14040:2006]

3.23
programme operator
body or bodies that conduct a Type III environmental declaration programme

Note 1 to entry: A program operator can be a company or a group of companies, industrial sector or trade association, public authorities or agencies, or an independent scientific body or other organization.

3.24
renewable energy
energy from renewable non-fossil sources

EXAMPLES Wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.

Note 1 to entry: Adapted from the definition in Directive 2009/28/EC.

3.25
renewable resource
resource that is grown, naturally replenished or naturally cleansed, on a human time scale

Note 1 to entry: A renewable resource is capable of being exhausted, but may last indefinitely with proper stewardship. Examples include: trees in forests, grasses in grassland, fertile soil.

Note 2 to entry: Activities that occur in the technosphere such as recycling are not considered natural replenishment or natural cleansing.

Note 3 to entry: In this context, human time scale refers to the typical life time of a human rather than the time humans have been in existence.

[SOURCE: ISO 21930:2017] 〈A2〉

〈A2〉 3.26
reference service life
RSL
service life of a construction product which is known to be expected under a set of reference in-use conditions and which can form the basis for estimating the service life under other in-use conditions

Note 1 to entry: The RSL is described as part of the functional unit and considered in the calculation of replacements at both the construction product level and construction works level (B4) and refurbishment (B5).

Note 2 to entry: The shorter acronym, RSL, is used as the preferred term in this document.

[SOURCE: ISO 21930:2017] 〈A2〉

〈A2〉 3.27 〈A2〉
reference service life data
RSL data
information that includes the reference service life and any qualitative or quantitative data describing the validity of the reference service life

EXAMPLE Typical data describing the validity of the RSL include the description of the component 〈A2〉 *deleted text* 〈A2〉 for which it applies, the reference in-use conditions under which it applies, and its quality.

[ISO 15686-8:2008]

〈A2〉 3.28 〈A2〉
scenario
collection of assumptions and information concerning an expected sequence of possible future events

〈A2〉 3.29 〈A2〉
secondary fuel
fuel recovered from previous use or from waste which substitutes primary fuels

〈A2〉 Note 1 to entry: 〈A2〉 Processes providing a secondary fuel are considered from the point where the secondary fuel enters the system from the previous system.

〈A2〉 Note 2 to entry: 〈A2〉 Any combustible material recovered from previous use or from waste from the previous product system and used as a fuel in a following system is a secondary fuel.

Note 〈A2〉 3 〈A2〉 to entry: Examples for primary fuels are: coal, natural gas, biomass, etc.

Note 〈A2〉 4 〈A2〉 to entry: Examples for secondary fuels recovered from previous use or as waste are: solvents, wood, tyres, oil, animal fats.

〈A2〉 3.30 〈A2〉
secondary material
material recovered from previous use or from waste which substitutes primary materials

Note 1 to entry: Secondary material is measured at the point where the secondary material enters the system from another system.

Note 2 to entry: Materials recovered from previous use or from waste from one product system and used as an input in another product system are secondary materials.

Note 3 to entry: Examples for secondary materials (to be measured at the system boundary) are recycled scrap metal, crushed concrete, glass cullet, recycled wood chips, recycled plastic.

3.31
specific data
data representative of a product, product group or construction service, provided by one supplier

3.32
third party
person or body that is recognized as being independent of the parties involved, as concerns the issues in question

Note 1 to entry: "Parties involved" are usually supplier ("first party") and purchaser ("second party") interests.

[EN ISO 14024:2000]

3.33
type III environmental declaration
environmental declaration providing quantified environmental data using predetermined indicators and, where relevant, additional environmental information

Note 1 to entry: The calculation of predetermined indicators is based on the ISO 14040 series of standards, which is made up of ISO 14040, and ISO 14044.

Note 2 to entry: Adapted from ISO 14025:2006.

3.34
upstream, downstream process
process(s) that either precedes (upstream) or follows (downstream) a given life cycle stage

3.35
unit process
the smallest element considered in the life cycle inventory analysis for which input and output data are quantified

[EN ISO 14040:2006]

3.36
waste
substance or object which the holder discards or intends or is required to discard

Note 1 to entry: Adapted from the definition in the European Waste Directive 2008/98/EC.

4 Abbreviations

c-PCR Complementary product category rules

CF Characterization Factor

EPDEnvironmental product declaration

PCR Product category rules

LCA Life cycle assessment

LCI Life cycle inventory analysis

LCIA Life cycle impact assessment

RSL Reference service life

ESL Estimated service life

〚A2〛 *deleted text* 〚A2〛

〚A1〛

GWP Global warming potential

〚A2〛 ND Not declared 〚A2〛

ODP Depletion potential of the stratospheric ozone layer

AP Acidification potential of soil and water

EP Eutrophication potential

〚A2〛 PEF Product Environmental Footprint 〚A2〛

POCP Formation potential of tropospheric ozone

ADP Abiotic depletion potential 〚A1〛

5 General aspects

5.1 Objective of the Core PCR

An EPD according to this standard provides quantified environmental information for a construction product or service on a harmonized and scientific basis. It also provides information on health related emissions to indoor air, soil and water during the use stage of the building. The purpose of an EPD in the construction sector is to provide the basis for assessing buildings and other construction works, and identifying those, which cause less stress to the environment.

Thus, the objective of the core PCR is to ensure:

— the provision of verifiable and consistent data for an EPD, based on LCA;

— the provision of verifiable and consistent product related technical data or scenarios for the assessment of the environmental performance of buildings;

— the provision of verifiable and consistent product related technical data or scenarios potentially related to the health of users for the assessment of the performance of buildings;

— that comparisons between construction products are carried out in the context of their application in the building;

— the communication of the environmental information of construction products from business to business;

— the basis, subject to additional requirements, for the communication of the environmental information of construction products to consumers.

Declarations based on this standard are not comparative assertions.

NOTE [A1] See definition 3.4 and ISO 14044:2006, 5.3 [/A1] for more information concerning LCA used for comparative assertion.

5.2 Types of EPD with respect to life cycle stages covered

[A2] All construction products and materials shall declare modules A1-A3, modules C1-C4 and module D.

Only products which fulfill all three of the conditions below shall be permitted to be exempt from this requirement:

— the product or material is physically integrated with other products during installation so they cannot be physically separated from them at end of life, and

— the product or material is no longer identifiable at end of life as a result of a physical or chemical transformation process, and

— the product or material does not contain biogenic carbon.

NOTE 1 This means any product containing biogenic carbon cannot omit the declaration of modules C1–C4 and module D.

Construction products and materials that are identified as exemptions may omit the declaration of modules C1–C4 and module D. Any omission of modules C1–C4 and module D shall be justified.

EPD not declaring modules C1–C4 and module D shall provide information on where to find scenarios for the end of life modules.

EXAMPLE End of life scenarios for cement can be found in EPD for concrete and mortar.

Types of EPD that may be provided are (see Figure 1):

— cradle to gate with modules C1–C4 and module D (A1–A3, C and D). These stages are the minimum to be declared for the default type of EPD. They shall be based on a declared unit;

— cradle to gate with options, modules C1–C4, and module D (A1–A3, C, D and additional modules. The additional modules may be A4 and/or A5 and/or B1–B7). This type of EPD shall be based on a functional unit or declared unit. If B-modules and use scenarios are not declared the EPD shall be based on a declared unit;

— cradle to grave and module D (A, B, C and D). This declaration shall be based on a functional unit or declared unit;

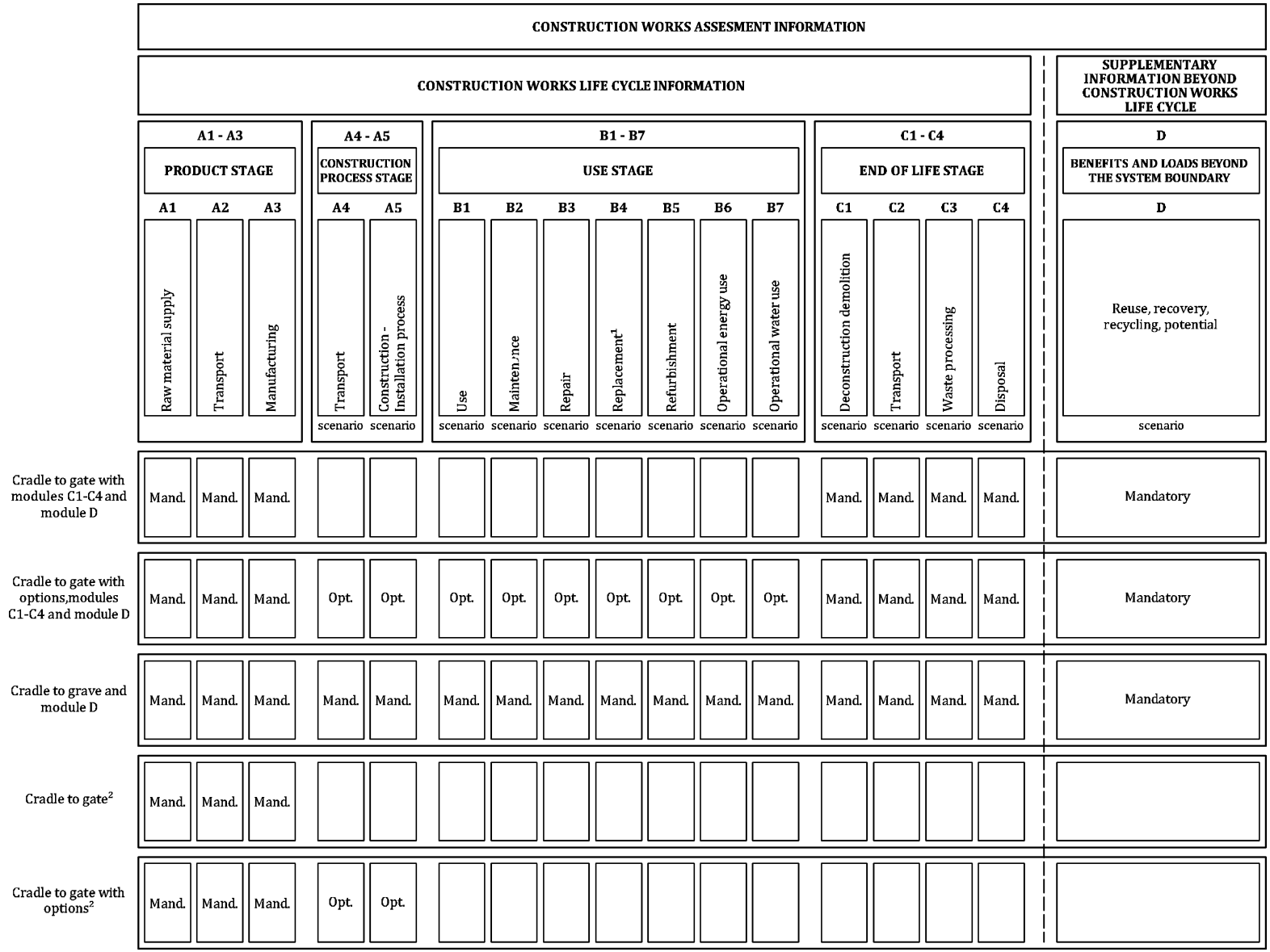
— cradle to gate (A1–A3). These stages are the minimum to be declared for all construction products that are exempt from declaring modules C and D and shall be based on a declared unit. This type of EPD is not allowed for products containing biogenic carbon;

— cradle to gate with options (A1–A3 and additional modules. The additional modules may be A4 and/or A5). This type of EPD is only possible for construction products that are exempt from declaring modules C and D. This type of EPD shall be based on a functional unit or declared unit. This type of EPD is not allowed for products containing biogenic carbon.

NOTE 2 Information modules can supply information for processes for which there is no EPD available, e.g. a cleaning process.

NOTE 3 A module contains, in addition to the indicator results, the values of the technical information underlying the quantification of pre-determined indicators, relevant technical information for further calculation of the environmental performance and the scenarios for further calculation of the indicator results.

NOTE 4 It is possible to have an EPD for a substance or preparation (e.g. cement), for a product (e.g. window), for a construction service (e.g. cleaning service as part of maintenance) and for an assemblage of products and/or a construction element (e.g. wall) or technical equipment (e.g. lift).



Key

1 replacement of components, parts or systems 2 only possible if the conditions to exclude the declaration of modules C1-C4 and module D are met

Figure 1 — Types of EPD with respect to life cycle stages covered and life cycle stages and modules for the construction works assessment A2

5.3 Comparability of EPD for construction products

In principle the comparison of products on the basis of their EPD is defined by the contribution they make to the environmental performance of the building. Consequently, comparison of the environmental performance of construction products using the EPD information shall be based on the product's use in and its impacts on the building, and shall consider the complete life cycle (all information modules).

NOTE 1 EPD that are not in a building context are not tools to compare construction products and construction services.

NOTE 2 For the sustainability assessment of buildings comparisons of the environmental aspects and impacts need to be undertaken in conjunction with the social and economic aspects and impacts related to the building.

NOTE 3 For the interpretation of a comparison, benchmarks or reference values are needed. This standard does not set benchmarks or reference values.

Comparisons are possible at the sub-building level, e.g. for assembled systems, components, products for one or more life cycle stages. In such cases the principle that the basis for comparison of the assessment is the entire building, shall be maintained by ensuring that:

— the same functional requirements as defined by legislation or in the client's brief are met, and

— the environmental performance and technical performance of any assembled systems, components, or products excluded are the same, and

— the amounts of any material excluded are the same, and

— ▌A2⟩ excluded processes, modules or life cycle stages are the same; and

— the influence of the product systems on the operational aspects and impacts of the construction works are taken into account;

— the elementary flows related to material inherent properties, such as biogenic carbon content, the potential to carbonate or the net calorific value of a material, are considered completely and consistently, as described in this standard. ⟨A2▌

The information provided for such comparison shall be transparent to allow the purchaser or user to understand the limitations of comparability. A justification shall be given for any excluded aspects.

NOTE 4 The difference between two products may be insignificant in the building context.

Where an EPD does not cover all life cycle stages relevant for the comparison or if the assumptions underlying the scenario of a declared information module are not applicable in the building context, then investigations will be required to determine the environmental aspects and impacts of specific scenarios for the calculation of modules beyond the cradle to gate modules. These calculations shall be based on scenarios and conditions that are appropriate for the building as the object of assessment.

5.4 ▌A2⟩ Additional environmental information

5.4.1 General

Any additional environmental information provided shall meet the requirements in EN ISO 14025:2010, 7.2.4.

In this core PCR, the following categories of additional information are addressed:

5.4.2 Additional impact indicators

This core PCR includes additional environmental impact indicators. The defined set of these LCA-based additional environmental impact indicators (see 7.2.3.2) shall be calculated and included in the project report. They may be declared in the EPD and if declared they shall be declared as additional environmental impact indicators including the appropriate disclaimers from Table 4 (see 7.2.3.3).

A complementary PCR (c-PCR) may define whether any of the additional environmental impact indicators listed in 7.2.3.2, shall be declared in the EPD.

5.4.3 Additional information on carbon offset, carbon storage and delayed emissions

Carbon offset processes are not part of the product system under study. Carbon offset shall not be included in the calculation of the GWP.

NOTE A carbon offset is a reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for an emission elsewhere.

The effect of temporary carbon storage and delayed emissions, i.e. the discounting of emissions and removals, shall not be included in the calculation of the GWP. The effect of permanent biogenic carbon storage shall also not be included in the calculation of the GWP.

5.4.4 Additional Information not derived from LCA

The following two categories of information not derived from LCA shall be addressed:

— Additional technical information, describing technical conditions underlying scenarios and characterising the product's technical and functional performance during the life cycle stages other than the product stage (A4–C4) and for the information provided under module D for any scenario-based calculation of the LCA based indicators (see 6.3.9 and 7.3).

— Additional information on emissions to indoor air, soil and water during the use stage, describing release of dangerous substances into indoor air, soil and water which are not covered by LCIA. This additional information is required (see 7.4).

NOTE Information concerning health related emissions to indoor air, soil and water supports the social performance of buildings which is addressed in EN 16309, *Sustainability of construction works — Assessment of social performance of buildings — Calculation methodology.* A2

5.5 Ownership, responsibility and liability for the EPD

A manufacturer or a group of manufacturers are the sole owners and have liability and responsibility for an EPD.

5.6 Communication formats

The communication format of the EPD shall be in accordance with EN 15942, *Sustainability of construction works — Environmental product declarations — Communication formats: business to business*.

6 Product Category Rules for LCA

6.1 Product category

The product category referred to in this standard includes all construction products and construction services for buildings and other construction works.

6.2 Life cycle stages and their information modules to be included

6.2.1 General

[A2] The environmental information of an EPD covering all life cycle stages and module D (cradle to grave and module D) shall be subdivided into the modules A1–A3, A4–A5, B1–B7, C1–C4 and module D. [A2]

Information modules within any of the life cycle stages are communicated depending on the types of EPD as specified in 5.2. They include impacts and aspects related to losses in the module in which the losses occur (i.e. production, transport, and waste processing and disposal of the lost waste products and materials).

6.2.2 A1-A3, Product stage, information modules

The product stage includes:

— A1, raw material extraction and processing, processing of secondary material input (e.g. recycling processes),

— A2, transport to the manufacturer,

— A3, manufacturing,

including provision of all materials, products and energy, as well as waste processing up to the end-of waste state ([A2] 6.3.5.5 [A2] and Annex B) or disposal of final residues during the product stage.

Module A1, A2 and A3 may be declared as one aggregated module A1-3.

6.2.3 A4-A5, Construction process stage, information modules

The construction process stage includes:

— A4, transport to the building site;

— A5, installation into the building;

including provision of all materials, products and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the construction process stage. These information modules also include all impacts and aspects related to any losses during this construction process stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

6.2.4 B1-B5, Use stage, information modules related to the building fabric

The use stage, related to the building fabric includes:

— B1, use or application of the installed product;

— B2, maintenance;

— B3, repair;

— B4, replacement;

— B5, refurbishment;

including provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during this part of the use stage. These information modules also include all impacts and aspects related to the losses during this

part of the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

6.2.5 B6-B7, use stage, information modules related to the operation of the building

The use stage related to the operation of the building includes:

— B6, operational energy use (e.g. operation of heating system and other building related installed services);

— B7, operational water use;

These information modules include provision and transport of all materials, products, as well as energy and water provisions, waste processing up to the end-of-waste state or disposal of final residues during this part of the use stage.

6.2.6 C1-C4 End-of-life stage, information modules

The end-of-life stage includes:

— C1, de-construction, demolition:

— C2, transport to waste processing;

— C3, waste processing for reuse, recovery and/or recycling;

— C4, disposal;

including provision and all transport, provision of all materials, products and related energy and water use.

6.2.7 D, Benefits and loads beyond the system boundary, information module

Module D includes:

— D, reuse, recovery and/or recycling potentials, expressed as net impacts and benefits.

6.3 Calculation rules for the LCA

6.3.1 〚A2〛 Functional or declared unit

A construction product may have a number of possible functions. Based on the goal and scope of an EPD, the EPD may relate to a specific function and scenario using a functional unit or it may cover a range of functionalities and scenarios using a declared unit.

Both the functional unit and declared unit provide a reference by means of which the material flows (input and output data) for each information module of a construction product are normalized (in a mathematical sense) to produce data, expressed on a common basis. The functional or declared unit provides the reference for combining material flows attributed to the construction product and for the addition of environmental impacts for the selected stages of the construction product's life cycle at the building level (see Figure 1 and 7.5 on aggregation). Therefore, any functional unit or declared unit shall be clearly defined and measurable.

NOTE In this standard the term "addition" also means the calculation of environmental impacts of a building or construction works (EN 15978) by summation of the quantified impacts per indicator and per module of the construction products constituting the building (e.g. adding kg CO_2 equivalents for bricks + mortar + wall insulation+ concrete block + gypsum plaster, etc.). Limitations on the addition of indicator results across life cycle stages and their modules are described in 7.5. 〚/A2〛

6.3.2 Functional unit

6.3.2.1 〚A2〛 General

The functional unit defines the way in which the identified functions or performance characteristics of the product are quantified. The primary purpose of the functional unit in LCA studies according to ISO 14044 is to provide a reference by which material flows, LCA results and any other information are normalized to produce data expressed on a common basis. This allows comparison with other product systems which have been assessed to fulfil the same functional unit.

NOTE 1 Comparisons of construction products with the same functional unit follow the rules in 5.3.

The functional unit of a construction product shall specify:

— the application of a product or product groups covered by the functional unit;

— the reference quantity for the functional unit when integrated in the construction works;

— the quantified key properties, when integrated into a building, for the functional use, quantified performance characteristics or minimum performance of the construction product, taking into account the functional equivalent of the building;

— the minimum performance characteristics under defined conditions shall be fulfilled over the defined time period of the functional unit;

— a specified period of time under reference in-use conditions considering the RSL. If the functional unit uses a different time period than the RSL, the RSL shall be given as technical information in the EPD (see 6.3.4).

For the development of scenarios, for example for transport and disposal, conversion factors to mass per declared or functional unit shall be provided.

For development of c-PCR, product CEN/TCs and other users of this standard shall specify performance characteristics and reference in-use conditions to be included in any functional unit.

NOTE 2 Guidance on the development of a functional unit is given in EN ISO 14040:2006, 5.2.2.

NOTE 3 Guidance on describing in-use conditions is given in Product Standards and ISO 15686-1, -2, -7 and -8.

NOTE 4 If no recognized and appropriate test methods exist, RSL can be developed in accordance with ISO 15686 by product CEN/TCs or allow the use of independent empirical evidence.

6.3.2.2 Performance in a functional unit

The future function of the product within the building or construction works is often uncertain, as the full functionality of a product may not be required at the building level. It is therefore difficult to define a complete functional unit, including information on the required technical performance of the product within the building or construction works over the full life cycle.

Nevertheless, for a cradle to grave EPD with a functional unit, a default (typical) application and the key functionalities shall be defined. These are normally required from the product or products in this application and provide other functional information as additional technical information.

The declared technical performance shall be based on specifications for determination or calculation of this performance given in the relevant European harmonized technical specification (harmonized European Standard and European Assessment Document) if available. 〚/A2〛

6.3.3 Declared unit

[A2] The declared unit shall be applied if a functional unit cannot be defined, e.g. since a function of the product cannot unequivocally be described because it can be used in many different ways in the context of construction works, or when the precise function of the product or scenarios at the building level is not stated or is unknown. The declared unit may also be used as an alternative to the functional unit.

An EPD based on a declared unit may cover all modules of the life cycle (i.e. cradle to grave) and module D. The declared unit shall relate to the typical applications of products and their RSL.

The declared unit in the EPD shall be declared applying one of the unit types listed below. A different unit may be declared for reasons that shall be explained. In such case, information shall be provided on how to convert this unit to one or more of the required unit types.

— An item (piece), an assemblage of items, e.g. 1 brick, 1 window (dimensions shall be specified);

— Mass (kg), e.g. 1 kg of cement;

— Length (m), e.g. 1 m of pipe, 1 m of a beam (dimensions shall be specified);

— Area (m^2), e.g. 1 m^2 of wall elements, 1 m^2 of roof elements (dimensions shall be specified);

— Volume (m^3), e.g. 1 m^3 of timber, 1 m^3 of ready-mixed concrete.

For the development of scenarios, for example for transport and disposal, conversion factors to mass per declared unit shall be provided. Product standards or a c-PCR may require additional conversion factors, for example to volume, for specific products.

An EPD based on a declared unit may provide one or more alternative scenarios for its information modules.

NOTE 1 Reasons for declaring units other than those listed include the need to use units normally used for design, planning, procurement and/or sale.

NOTE 2 CEN Technical Committees for product standards are expected to harmonize the declared unit to be used for their product families. [A2]

6.3.4 Reference service life (RSL)

6.3.4.1 [A2] General

RSL information to be declared in an EPD covering the use stage shall be provided by the manufacturer. The RSL shall be specified under defined reference in-use conditions. The RSL shall refer to the declared technical and functional performance of the product within construction works. The RSL shall be established in accordance with any specific rules given in European product standards or, if not available, a c-PCR, and shall take into account ISO 15686-1, -2, -7 and -8. Where European product standards or a c-PCR provide guidance on deriving the RSL, such guidance shall have priority.

Information on the product's RSL requires specification of compatible scenarios for the product stage, construction process stage and use stage. RSL is dependent on the properties of the product and reference in-use conditions. The RSL shall be declared together with the reference in-use conditions and it shall be stated that the RSL applies for the reference in-use conditions only.

The reference in-use conditions for achieving the declared technical and functional performance and the declared RSL shall include the following, where relevant:

— declared product properties (at the gate) and those of any finishes, etc.;

— design application parameters (if instructed by the manufacturer), including references to any appropriate requirements and application codes;

— an assumed quality of work;

— external environment, (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature;

— internal environment (for indoor applications), e.g. temperature, moisture, chemical exposure;

— usage conditions, e.g. frequency of use, mechanical exposure;

— maintenance, e.g. required frequency, type and quality and replacement of replaceable components.

The RSL shall be justified and verifiable.

Requirements and guidance on the RSL are given in normative Annex A.

6.3.4.2 Scenarios for RSL and functional unit

For EPD based on functional units, the reference in-use conditions used to define the RSL, functional unit and any scenarios shall be consistent.

A declared RSL for a construction product shall relate to its declared technical performance and to any maintenance or repair necessary to provide the declared performance during the RSL. Therefore, any scenario included for A4, A5 and B1–B7 shall be based on the specific reference in-use conditions for the RSL. Scenarios for all modules for a cradle to grave EPD shall also be consistent with the reference in-use conditions of the RSL (e.g. if a certain location is assumed for the construction stage, this assumption shall be reflected consistently for all declared subsequent modules i.e. the use stage, end of life stage and module D). 〈A2〉

6.3.5 System boundaries

6.3.5.1 General

LCA is conducted by defining product systems as models describing the key elements of physical systems. The system boundary defines the unit processes to be included in the system model.

This clause specifies the boundary of the product system under study and in particular the boundary with any previous or subsequent product systems in the life of a building. It also specifies the processes that are to be included in each of the life cycle stages listed in 6.2 (according to Figure 1).

The modular set up of the LCA underlying an EPD (see Figure 1) allows easy organisation and expression of data packages throughout the life cycle of the product. This approach requires that the system boundaries for the life cycle stages and the information modules included are transparent, well defined and applicable to any construction product.

The setting of the system boundaries follows the two principles:

— The “modularity principle”: Where processes influence the product’s environmental performance during its life cycle, they shall be assigned to the module of the life cycle where they occur; all environmental aspects and impacts are declared in the life cycle stage where they appear;

— The “polluter pays principle”: Processes of waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached.

For instance:

— [A2] the cradle to gate, modules A4–A5 and modules C1–C4 information of a cleaning agent used for maintenance of the product is declared in the product's life cycle module B2 "maintenance", the module D for the cleaning agent is declared in the product's module D. In all cases, the scenarios in the cleaning agent EPD shall be appropriate to the product scenarios or the use and end of life of the cleaning product shall be remodelled; [A2]

— The aspects and impacts of the construction process stage include the aspects and impacts due to any wastage of construction products during that stage, for example,. by cutting the product to size. The aspects and impacts of transport processes include the aspects and impacts due to any wastage of construction products during that stage, for example, due to breakage.

[A2] These principles are used in the following clauses and are reflected in the formulae in Annex D. These formulae may be used as support while making calculations. No other formulae shall be used for the implementation of the principles in this clause. [A2]

NOTE For reasons of transparency and traceability individual information modules describing services during the use stage, e.g. B2 maintenance, may be subdivided into information modules describing B2 in more detail, e.g. B.2.1: Product stage: environmental impacts due to provision of materials and energy for maintenance processes, B.2.2: Use stage: environmental aspects and impacts due to the maintenance processes, B.2.3: End-of-life stage: waste processing and waste transport for materials applied during maintenance.

6.3.5.2 Product stage

The product stage is an information module required to be included in the EPD. As illustrated in Figure 1 it includes the information modules A1 to A3. The system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, and transport processes up to the factory gate as well as the processing of any waste arising from those processes.

In the case of input of secondary materials or energy recovered from secondary fuels, the system boundary between the system under study and the previous system (providing the secondary materials) is set where outputs of the previous system, e.g. materials, products, building elements or energy, reach the end-of-waste state (see [A2] 6.3.5.5 [A2] and Annex B).

Flows leaving the system at the end-of-waste boundary of the product stage (A1-A3) shall be allocated as co-products (see 6.4.3.2). Loads and benefits from allocated co-products shall not be declared in Module D (see [A2] 6.3.5.6 [A2]). If such a co-product allocation is not possible, other methods may be chosen and shall be justified. Therefore, as a general rule, potential loads or benefits from A1-A3 do not appear in module D.

The product stage includes:

— A1 Extraction and processing of raw materials (e.g. mining processes) and biomass production and processing (e.g. agricultural or forestry operations);

— A1 Reuse of products or materials from a previous product system;

— A1 Processing of secondary materials used as input for manufacturing the product, but not including those processes that are part of the waste processing in the previous product system;

— A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

— A1 Energy recovery and other recovery processes from secondary fuels, but not including those processes that are part of waste processing in the previous product system;

— A2 Transportation up to the factory gate and internal transport;

— A3 Production of ancillary materials or pre-products;

— A3 Manufacturing of products and co-products;

— A3 Manufacturing of Packaging;

— A1-A3 processing up to the end-of-waste state or disposal of final residues including any packaging not leaving the factory gate with the product.

Regardless of the geographical coverage of a product system the rules for defining the end-of-waste state of this European standard apply.

NOTE The output of waste during this life cycle stage may reach the end-of-waste state when it complies with the conditions described in ▌A2⟩ 6.3.5.5 ⟨A2▐, end-of-life stage. They are then allocated as co-products as 6.4.3.2.

▌A2⟩ The system boundary with nature is defined as the point when material transfers from natural systems to the technosphere (i.e. when material flows are caused or influenced by human technological activity) and when emissions are released from the technosphere to nature. The studied system should therefore include all processes in the technosphere which are necessary to provide the functional or declared unit of the product. ⟨A2▐

6.3.5.3 Construction stage

The construction process stage includes the optional information modules for:

— A4 Transportation from the production gate to the construction site;

— A4-A5 Storage of products, including the provision of heating, cooling, humidity control, etc.;

— A4-A5 wastage of construction products (additional production processes to compensate for the loss of wastage of products);

— A4-A5 waste processing of the waste from product packaging and product wastage during the construction processes up to the end-of-waste state or disposal of final residues;

— A5 Installation of the product into the building including manufacture and transportation of ancillary materials and any energy or water required for installation or operation of the construction site. It also includes on-site operations to the product.

6.3.5.4 Use stage

6.3.5.4.1 General

The use stage includes the optional information modules covering the period from the handover of the building or construction works to when it is deconstructed or demolished. The duration of the use stage of products may be different from the required service life of a building.

The use stage includes the use of construction products, equipment and services in their proper function. It also includes their use for protecting, conserving, moderating or controlling a building, e.g. modules describing the building operation through building related services such as heating, cooling, lighting, water supply and internal transport (provided e.g. by lifts and escalators). It also includes maintenance (including cleaning), repair, replacement and refurbishment.

It is recognised that it may be difficult to separate all use stage processes and the connected aspects and impacts into these separate modules. However, any deviation from the categorisation of aspects and impacts into Modules B1-B5 and B6-B7 shall be transparently reported and justified.

6.3.5.4.2 B1-B5 Use stage information modules related to the building fabric:

— **B1 Use of the installed product** in terms of any emissions to the environment (not covered by B2-B7)

The module "use of the installed product" covers environmental aspects and impacts arising from components of the building and construction works during their normal (i.e. anticipated) use, which are assigned to module B1.

EXAMPLE 1 Release of substances from the facade, roof, floor covering and other surfaces (interior or exterior) to indoor air, soil or water.

NOTE 1 The EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available, the EPD can lack this information.

— **B2 Maintenance**

The module "Maintenance" covers the combination of all planned technical and associated administrative actions during the service life to maintain the product installed in a building, in a construction works or its parts in a state in which it can perform its required functional and technical performance, as well as preserve the aesthetic qualities of the product. This will include preventative and regular maintenance activity such as cleaning, and the planned servicing, replacement or mending of worn, damaged or degraded parts. Water and energy usage required for cleaning, as part of maintenance shall be included in this module, and not in modules B6 and B7.

NOTE 2 Maintenance, repair and replacement of a whole section of the building as part of a concerted programme for the building would be considered as refurbishment.

The boundary of "maintenance" shall include in addition:

— the production and transportation of any component and ancillary products used for maintenance, including cleaning;

— transportation of any waste from maintenance processes or from maintenance related transportation;

— the end-of-life processes of any waste from transportation and the maintenance process, including any part of the component and ancillary materials removed.

EXAMPLE 2 Painting work on window frames, doors, etc. as well as the annual inspection and maintenance of the (oil or gas) boiler, replacement of filters in the heat recovery or air conditioning system.

— **B3 Repair**

The module "repair" covers a combination of all technical and associated administrative actions during the service life associated with corrective, responsive or reactive treatment of a construction product or its parts installed in the building or construction works to return it to an acceptable condition in which it can perform its required functional and technical performance. It also covers the preservation of the aesthetic qualities of the product. Replacement of a broken component or part due to damage should be assigned to "repair", whereas replacement of a whole element due to damage should be assigned to the module "replacement".

The boundary for "repair" shall include:

a) repair process of the repaired part of a component including:

   1) the production of the repaired part of a component and of ancillary materials;

2) use of related energy and water;

3) the production and transport aspects and impacts of any wastage of materials during the repair process;

b) the transportation of the repaired part of component and ancillary materials, including production aspects and impacts of any waste of materials during the repair related transportation;

c) the-end-of-life processes of any waste from transportation and the repair process, including the part of the component and ancillary materials removed.

EXAMPLE 3 For a window with broken glass, this includes the production and transportation of new glass and packaging, and all impacts due to the repair process (rubber seal, water for cleaning, etc), and the end-of-life stage of the glass waste and any related packaging.

— **B4 Replacement**

The module "replacement" covers the combination of all technical and associated administrative actions during the service life associated with the return of a construction product to a condition in which it can perform its required functional or technical performance, by replacement of a whole construction element.

Replacement of a broken component or part due to damage should be included as "repair", but replacement of a whole construction element due to damage should be considered as "replacement". Replacement of a whole construction element as part of a concerted replacement programme for the building should be considered as "refurbishment".

The boundary for "replacement" shall include:

— the production of the components and of ancillary materials used for replacement;

— replacement process, including related water and energy use and the production aspects and impacts of any waste of materials used during the replacement process;

— the transportation of the component and ancillary materials used for replacement, including production aspects and impacts of any losses of material damaged during transportation;

— [A2] the end-of-life processes of any losses suffered during transportation and the replacement process and the components and ancillary materials removed. [A2]

EXAMPLE 4 For a carpet being replaced at the end of its service life, this includes the production and transportation of the new carpet and packaging, and all impacts due to the replacement process (adhesive, vacuum cleaning etc.), and the end of life stage of the original carpet, any waste from the installation of the replacement carpet, packaging waste and adhesive.

— **B5 Refurbishment**

The module "refurbishment" covers the combination of all technical and associated administrative actions during the service life of a product associated with the return of a building or other construction works or their parts to a condition in which it can perform its required functions. These activities cover a concerted programme of maintenance, repair and/or replacement activity, across a significant part or whole section of the building.

Restoration activities should be included within refurbishment.

The boundary for refurbishment shall include:

— the production of the components and ancillary materials used for refurbishment;

— refurbishment process and related water and energy use including production aspects and impacts of any waste of materials used during the refurbishment process;

— the transportation of the component and ancillary materials used for refurbishment, including production aspects and impacts of any losses during transportation;

— the end-of-life processes of any losses suffered during transportation and the refurbishment process, including the components and ancillary materials removed.

6.3.5.4.3 B6 – B7 use stage information modules related to the operation of the building:

— **B6 Energy use to operate building integrated technical systems**

The boundary of the module "Energy use to operate building integrated technical systems'' shall include energy use during the operation of the product (the integrated building technical system), together with its associated environmental aspects and impacts including processing and transportation of any waste arising on site from the use of energy.

Integrated building technical systems are installed technical equipment supporting operation of a building or construction works. This includes technical building systems for heating, cooling, ventilation, lighting, domestic hot water and other systems for sanitation, security, fire safety, internal transport and building automation and control and IT communications.

[A2⟩ *deleted text* ⟨A2]

Aspects related to the production, transportation and installation of equipment required to supply energy to the building shall be assigned to Modules A1-A5. Energy use during maintenance, repair, replacement or refurbishment activities for the equipment shall be assigned to Modules B2-B5. Aspects related to the waste processing and final disposal of equipment shall be assigned to Modules C1-C4.

— **B7 operational water use by building integrated technical systems**

The module "Operational water use by building integrated technical systems" covers the period from the handover of the building or construction works to when the building is deconstructed or demolished.

The boundary of the module "operational water use by building integrated technical systems" shall include water use during the operation of the product (the building integrated technical system), together with its associated environmental aspects and impacts considering the life cycle of water including production and transportation and waste water treatment.

Building integrated technical systems are installed technical equipment to support operation of building. This includes technical building systems for cooling, ventilation, humidification, domestic hot water and other systems for sanitation, security, fire safety, internal transport.

6.3.5.5 End-of-life stage

The end-of-life stage of the construction product starts when it is replaced, dismantled or deconstructed from the building or construction works and does not provide any further functionality. It can also start at the end-of-life of the building, depending on choice of the product's end-of-life scenario.

During the end-of-life stage of the product or the building, all output from dismantling, deconstruction or demolition of the building, from maintenance, repair, replacement or refurbishing processes, all debris, all construction products, materials or construction elements, etc. leaving the building, are at first considered to be waste. This output however reaches the end-of-waste state when it complies with all the following criteria:

— the recovered material, product or construction element is commonly used for specific purposes;

— a market or demand, identified e.g. by a positive economic value, exists for such a recovered material, product or construction element;

— the recovered material, product or construction element fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products;

— the use of the recovered material, product or construction element will not lead to overall adverse environmental or human health impacts.

NOTE 1 The "specific purpose" in this context is not restricted to the function of a certain product but can also be applied to a material serving as input to the production process of another product or of energy.

The criterion for "overall adverse environmental or human health impacts" shall refer to the limit values for pollutants set by regulations in place at the time of assessment and where necessary shall take into account adverse environmental effects. The presence of any hazardous substances exceeding these limits in the waste or showing one or more properties as listed in existing applicable legislation, e.g. in the European Waste Framework Directive, prevents the waste from reaching the end-of-waste state.

The end-of-life system boundary of the construction product system to module D is set where outputs, i.e. secondary materials or fuels, have reached the “end-of-waste” state (see [A2] 6.4.3.3 [A2]).

The end-of-life stage includes the [A2] *deleted text* [A2] modules:

— C1 deconstruction, including dismantling or demolition, of the product from the building, including initial on-site sorting of the materials;

— C2 transportation of the discarded product as part of the waste processing, e.g. to a recycling site and transportation of waste e.g. to final disposal;

— C3 waste processing e.g. collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery. Waste processing shall be modelled and the elementary flows shall be included in the inventory. Materials for energy recovery are identified based on the efficiency of energy recovery with a rate higher than 60 % without prejudice to existing legislation. Materials from which energy is recovered with an efficiency rate below 60% are not considered materials for energy recovery.

NOTE 2 Only when materials have reached the end-of-waste-state can they be considered as materials for energy recovery, provided the energy recovery process has an energy efficiency rate higher than 60%.

— C4 waste disposal including physical pre-treatment and management of the disposal site.

NOTE 3 In principle waste processing is part of the product system under study. In the case of materials leaving the system as secondary materials or fuels, such processes as collection and transport before the end-of-waste state are, as a rule, part of the waste processing of the system under study. However after having reached the “end-of-waste” state further processing may also be necessary in order to replace primary material or fuel input in another product system. Such processes are considered to be beyond the system boundary and are assigned to module D. Secondary material having left the system can be declared as substituting primary production in module D, when it has reached functional equivalence of the substituted primary material.

[A2] The degradation of a product’s biogenic carbon content in a solid waste disposal site, declared as GWP-biogenic, shall be calculated without time limit. Any remaining biogenic carbon is treated as an emission of biogenic CO_2 from the technosphere to nature. For the time period applicable to all other disposals see 6.3.8.2.

NOTE 4 Waste disposals for products containing biogenic carbon declared as GWP-biogenic are modelled as closely to reality as possible based on current practices. [A2]

Loads, (e.g. emissions) from waste disposal in module C4 are considered part of the product system under study, according to the "polluter pays principle". If however this process generates energy such as heat and power from waste incineration or landfill the potential benefits from utilisation of such energy in the next product system are assigned to module D and are calculated using current average substitution processes.

6.3.5.6 Benefits and loads beyond the product system boundary in module D

Information module D aims at transparency for the environmental benefits or loads resulting from reusable products, recyclable materials and/or useful energy carriers leaving a product system e.g. as secondary materials or fuels.

[A2] Any declared net benefits and loads from net flows (for calculation of the net amounts see 6.4.3.3) leaving the product system that have passed the end-of-waste state shall be included in module D, except those which have been allocated as co-products. [A2]

Avoided impacts from allocated co-products shall not be included in Module D.

[A2] The information in module D shall contain technical information as well as the declared indicators, as described in Clause 7. [A2]

6.3.6 Criteria for the exclusion of inputs and outputs

Criteria for the exclusion of inputs and outputs (cut-off rules) in the LCA and information modules and any additional information are intended to support an efficient calculation procedure. They shall not be applied in order to hide data. Any application of the criteria for the exclusion of inputs and outputs shall be documented.

The following procedure shall be followed for the exclusion of inputs and outputs:

— All inputs and outputs to a (unit) process shall be included in the calculation, for which data are available. Data gaps may be filled by conservative assumptions with average or generic data. Any assumptions for such choices shall be documented;

— In case of insufficient input data or data gaps for a unit process, the cut-off criteria shall be 1 % of renewable and non-renewable primary energy usage and 1 % of the total mass input of that unit process. The total of neglected input flows per module, e.g. per module A1-A3, A4-A5, B1-B5, B6-B7, C1-C4 and module D (see Figure 1) shall be a maximum of 5 % of energy usage and mass. Conservative assumptions in combination with plausibility considerations and expert judgement can be used to demonstrate compliance with these criteria;

— Particular care should be taken to include material and energy flows known to have the potential to cause significant emissions into air and water or soil related to the environmental indicators of this standard. Conservative assumptions in combination with plausibility considerations and expert judgement can be used to demonstrate compliance with these criteria.

6.3.7 Selection of data

As a general rule, specific data derived from specific production processes or average data derived from specific production processes shall be the first choice as a basis for calculating an EPD. In addition the following rules apply:

— An EPD describing an average product shall be calculated using representative average data of the products declared by the EPD;

— An EPD describing a specific product shall be calculated using specific data for at least the processes the producer of the specific product has influence over. Generic data may be used for the processes the producer cannot influence e.g. processes dealing with the production of input

commodities, e.g. raw material extraction or electricity generation, often referred to as upstream data (see Table 1);

— A specific EPD covering all life cycle stages (cradle to grave) may be calculated using generic data for some downstream processes e.g. waste incineration. For the sake of comparability the calculation of the use stage shall be based on the same additional technical information as is required in 7.3;

— The additional technical information for the development of scenarios of the building's life cycle stages shall be specific or specific average information, when an average product is declared;

— Documentation of technological, geographical and time related representativity for generic data shall be provided in the project report.

Table 1 — Application of generic and specific data

Modules	Module A1-A3		A4 and A5	B1-B7	C1-C4
	Production of commodities, raw materials	Product manufacture	Installation processes	Use processes	End-of-life processes
Process type	Upstream processes	Processes the manufacturer has influence over	Downstream processes		
Data type	Generic data	Manufacturer's average or specific data	Generic data		

NOTE Generic data is publicly available and may be average or specific. Normally it is used to describe upstream and downstream processes. See CEN/TR 15941, *Sustainability of construction works — Environmental product declarations — Methodology for selection and use of generic data*.

6.3.8 〚A2〛 Data quality 〚A2〛

6.3.8.1 〚A2〛 General

The quality of the data used to calculate an EPD shall be addressed in the project report (see Clause 8 and EN ISO 14044:2006, 4.2.3.6).

6.3.8.2 Data quality requirements

The following specific requirements apply:

— the documentation format and data sets for the LC inventory data used in the LCA modelling shall use the current ILCD format and nomenclature as defined in the document, "International Reference Life Cycle Data System (ILCD) Handbook - Nomenclature and other conventions";

NOTE 1 The elementary flow list is available at the following web-link: http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml.

The elementary flow list is available both in ILCD structure and as Excel file and it is identified by the name EN_15804.

— guidance for the selection and use of generic data is provided in CEN/TR 15941;

— generic data shall be checked for plausibility;

NOTE 2 Plausibility can be checked by mass balance, energy balance, comparison of indicators to those of data sets reviewed or verified according to this standard, or comparison of flows or indicators to other relevant sources of information.

— data sets shall be complete according to the system boundary within the limits set by the criteria for the exclusion of inputs and outputs (see 6.3.6);

— data shall be as current as possible. Data sets used for calculations shall be valid for the current year and represent a reference year within 10 years for generic data and 5 years for producer specific data;

— the reference year refers to the year which the overall inventory represents best, considering the age/representativeness of the various specific and background data included, i.e. not automatically the year of modelling, calculation or publication year. Validity of data sets refers to the date to which the inventory is still judged sufficiently valid with the documented technological and geographical representativeness;

— data sets shall be based on 1 year averaged data; deviations shall be justified;

— the time period over which inputs to and outputs from the system shall be accounted for is 100 years from the year for which the data set is deemed representative. However, for solid waste disposal of products containing biogenic carbon declared as GWP-biogenic, see 6.3.5.5;

— the technological coverage shall reflect the physical reality for the declared product or product group by as far as possible taking into account:

  — representativeness for the technology mix and location type stated in the documentation;

— the geographical coverage shall reflect the physical reality for the declared product or product group by as far as possible taking into account:

  — technology representativeness for the region/country;

  — input materials representativeness for the region/country;

  — input energies representativeness for the region/country.

6.3.8.3 Data quality assessment schemes applied on generic and specific data used and established in the EPD

Generic data (see Table 1) shall include data quality assessment information according to EN ISO 14044:2006, 4.2.3.6. The data quality assessment information shall cover at least the following elements:

— time-related coverage;

— geography coverage;

— technology coverage.

It shall be based on either of the two systems described in Annex E.

The quality of the life cycle inventory data established for the EPD shall also be assessed accordingly.

For the relevant generic datasets used in the EPD as well as for the relevant life cycle inventory data established for the EPD, the type of data quality assessment system used and the data quality results shall be documented in the project report.

The term "relevant data" is understood as data with a major contribution, contributing together to at least 80 % of the absolute impact of any core environmental indicators included in the EPD, considered over the full life cycle, excluding module D, or across those modules of the life cycle assessed in the EPD. The data quality of module D shall also be assessed. ⟨A2⟩

6.3.9 Developing product level scenarios

⟩A2⟩ *deleted text* ⟨A2⟨

Scenarios shall be provided only for the environmental assessment. A scenario shall be based on the relevant technical information defined in this standard (see 5.4 and 7.3, for additional information). The kind of technical information the scenario is based on, is described in 7.3. With the help of the scenario, the predetermined ⟩A2⟩ indicators ⟨A2⟨ of the EPD are derived by applying the calculation rules given in this standard.

⟩A2⟩ Scenarios shall support the calculation of information modules covering processes that deal with any one or all of the life cycle stages of the construction product except for modules A1–A3; scenarios shall support the assessment of the environmental performance of a building in its life cycle stages "construction, use stage, end of life" (see Figure 1). ⟨A2⟨

A scenario shall be realistic and representative of one of the most probable alternatives. (If there are, e.g. three different applications, the most representative one, or all three scenarios shall be declared). Scenarios shall not include processes or procedures that are not in current use or which have not been demonstrated to be practical.

EXAMPLE 1 A recycling system is not practical if it includes a reference to a return system for which the logistics have not been established.

EXAMPLE 2 Energy recovery needs to be based on existing technology and current practice.

⟩A2⟩ Scenarios are communicated in accordance with 5.4. For EPD that declare any or all modules beyond the production stage, the technical information describing the scenarios for these modules is required together with the quantified environmental impacts of the modules based on them. See also 7.3. ⟨A2⟨

6.3.10 Units

SI units shall be used. Basic units are: metre (m), kilogram (kg), molecular weight in grams (mol). With the exceptions noted below, all resources are expressed in kg.

Exceptions are:

— Resources used for energy input (primary energy), which are expressed as kWh or MJ, including renewable energy sources e.g. hydropower, wind power;

— Water use, which is expressed in m^3 (cubic metres)

— Temperature, which is expressed in degrees Celsius;

— Time, which is expressed in practical units depending on the assessment scale: minutes, hours, days, years.

6.4 Inventory analysis

6.4.1 Collecting data

Data collection shall follow the guidance provided in EN ISO 14044:2006, 4.3.2.

6.4.2 Calculation procedures

The calculation procedures described in EN ISO 14044 shall apply. The same calculation procedures shall be applied consistently throughout the study.

When transforming the inputs and outputs of combustible material into inputs and outputs of energy the net calorific value of fuels shall be applied according to scientifically based and accepted values specific to the combustible material.

6.4.3 Allocation of input flows and output emissions

6.4.3.1 General

Most industrial processes produce more than the intended product. Normally more than one input is needed to produce one product and sometimes products are co-produced with other products. As a rule the material flows between them are not distributed in a simple way. Intermediate and discarded products can be recycled to become inputs for other processes. When dealing with systems involving multiple products and recycling processes, allocation should be avoided as far as possible. Where unavoidable, allocation should be considered carefully and should be justified.

In this standard, the rules for allocation are based on the guidance given in EN ISO 14044:2006, 4.3.4. However, the basic procedures and assumptions used in EN ISO 14044 have been refined in order to reflect the goal and scope of this standard and EN 15643-2.

The use of upstream data, which does not respect the allocation principles described in this standard shall be clearly stated and justified in the project report. These data shall be in line with EN ISO 14044 allocation rules.

The principle of modularity shall be maintained. Where processes influence the product's environmental performance during its life cycle, they shall be assigned to the module in the life cycle where they occur (see Figure 1).

The sum of the allocated inputs and outputs of a unit process shall be equal to the inputs and outputs of the unit process before allocation. This means no double counting or omission of inputs or outputs through allocation is permitted.

〚A2〛 Irrespective of the allocation approach chosen for a co-production process or for secondary flows crossing the system boundary between product systems, specific inherent properties of such coproducts or flows, for example calorific content, composition [biogenic carbon content, $CaO/Ca(OH)_2$ content, etc.], shall not be allocated but always reflect the physical flows. 〚A2〛

6.4.3.2 Co-product allocation

Allocation shall be avoided as far as possible by dividing the unit process to be allocated into different sub-processes that can be allocated to the co-products and by collecting the input and output data related to these sub-processes.

— If a process can be sub-divided but respective data are not available, the inputs and outputs of the system under study should be partitioned between its different products or functions in a way which reflects the underlying physical relationships between them; i.e. they shall reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system;

In the case of joint co-production, where the processes cannot be sub-divided, allocation shall respect the main purpose of the processes studied, allocating all relevant products and functions appropriately. The purpose of a plant and therefore of the related processes is generally declared in its permit and should be taken into account. Processes generating a very low contribution to the overall revenue may be neglected. Joint co-product allocation shall be allocated as follows:

— Allocation shall be based on physical properties (e.g. mass, volume) when the difference in revenue from the co-products is low;

— In all other cases allocation shall be based on economic values;

— Material flows carrying specific inherent properties, e.g. energy content, elementary composition (e.g. biogenic carbon content), shall always be allocated reflecting the physical flows, irrespective of the allocation chosen for the process.

NOTE 1 Contributions to the overall revenue of the order of 1% or less is regarded as very low. A difference in revenue of more than 25 % is regarded as high.

NOTE 2 A common position on the definition on the most appropriate allocation rule needs to be defined together with other relevant sectors.

NOTE 3 Products and functions are the outputs and/or services provided by the process, having a positive economic value.

NOTE 4 In industrial processes there may be a wide variety of different types of materials produced in conjunction with the intended product. In business vocabulary, these may be identified as by-products, co-products, intermediate products, non-core products or sub-products. In this standard these terms are treated as being equivalent. However for the allocation of environmental aspects and impacts a distinction between co-products and products is made in this standard.

6.4.3.3 Allocation procedure of reuse, recycling and recovery

The end-of-life system boundary of the construction product system is set where outputs of the system under study, e.g. materials, products or construction elements, have reached the end-of-waste state. Therefore, waste processing of the material flows (e.g. undergoing recovery or recycling processes) during any module of the product system (e.g. during the production stage, use stage or end-of-life stage) are included up to the system boundary of the respective module as defined above.

Where relevant (see [A2] 6.3.5.5 [A2] and [A2] 6.3.5.6 [A2]), [A2] information module D [A2] declares potential loads and benefits of secondary material, secondary fuel or recovered energy leaving the product system. Module D recognises the “design for reuse, recycling and recovery” concept for buildings by indicating the potential benefits of avoided future use of primary materials and fuels while taking into account the loads associated with the recycling and recovery processes beyond the system boundary.

NOTE 1 Module D also contains benefits from exported energy from waste disposal processes declared in module C4.

Where a secondary material or fuel crosses the system boundary e.g. at the end-of-waste state and if it substitutes another material or fuel in the following product system, the potential benefits or avoided loads can be calculated based on a specified scenario which is consistent with any other scenario for waste processing and is based on current average technology or practice.

If today’s average is not available for the quantification of potential benefits or avoided loads, a conservative approach shall be used.

In module D the net impacts are calculated as follows:

— by adding all output flows of a secondary material or fuel and subtracting all input flows of this secondary material or fuel from each sub-module first (e.g. B1-B5, C1-C4, etc.), then from the

modules (e.g. B, C), and finally from the total product system thus arriving at net output flows of secondary material or fuel from the product system;

— by adding the impacts connected to the recycling or recovery processes from beyond the system boundary (after the end-of-waste state) up to the point of functional equivalence where the secondary material or energy substitutes primary production and subtracting the impacts resulting from the substituted production of the product or substituted generation of energy from primary sources;

— by applying a justified value-correction factor to reflect the difference in functional equivalence where the output flow does not reach the functional equivalence of the substituting process.

In module D substitution effects are calculated only for the resulting net output flow.

The amount of secondary material output, which is for all practical purposes able to replace one to one the input of secondary material as closed loop is allocated to the product system under study and not to module D.

NOTE 2 Avoided impacts from allocated co-products are not part of Module D information, see 6.3.5.6.

6.4.4 Information on biogenic carbon content

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it shall be separately declared for the product and for any accompanying packaging (see 7.2.5).

NOTE The biogenic carbon content of wood based products can be measured or calculated according to EN 16449, Wood and wood-based products — Calculation of the biogenic carbon content of wood and conversion to carbon dioxide.

If the mass of biogenic carbon containing materials in the product is less than 5 % of the mass of the product, the declaration of biogenic carbon content may be omitted.

If the mass of biogenic carbon containing materials in the packaging is less than 5 % of the total mass of the packaging, the declaration of the biogenic carbon content of the packaging may be omitted.

The mass of packaging shall always be declared.

6.5 Impact assessment

6.5.1 General

The information on environmental impacts is expressed with the impact category indicators of Life Cycle Impact Assessment (LCIA) using characterisation factors in a LCIA according to ISO 14044. Information on the impact categories, indicators, characterisation methods, units and characterisation factors to be applied is stated in Annex C.

The EPD shall contain a core set of pre-determined environmental impact indicators. The EPD may also contain additional environmental impact indicators.

6.5.2 Core environmental impact indicators

The core environmental impact indicators are listed in Table 3 (see 7.2.3.1).

Table C.1 lists these indicators together with their units and the applicable characterisation models.

For all indicators mentioned in Annex C, the characterization factors from EC-JRC shall be applied. The characterization factors are available at the following web-link:

http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml.

The characterization factors are available both in ILCD structure and as Excel file and they are identified by the name EN_15804.

6.5.3 Additional environmental impact indicators

The additional environmental impact indicators are listed in Table 4.

Table C.2 lists these indicators together with their units and the applicable characterisation models.

For all indicators mentioned in Annex C, the characterization factors from EC-JRC shall be applied. The characterization factors are available at the following web-link:

http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml.

The characterization factors are available both in ILCD structure and as Excel file and they are identified by the name EN_15804. 〈A2〉

7 Content of the EPD

7.1 Declaration of general information

The following items of general information are required and shall be declared in an EPD.

a) the name and address of the manufacturer(s);

b) the description of the construction product's use and the functional or declared unit of the construction product to which the data relates;

c) construction product identification by name (including any product code) and a simple visual representation of the construction product to which the data relates;

d) a description of the main product components and or materials;

NOTE 1 This description is intended to enable the user of the EPD to understand the composition of the product as delivered and also support safe and effective installation, use and disposal of the product.

e) name of the programme used and the programme operator's name and address and, if relevant logo and website;

f) the date the declaration was issued and the 5 year period of validity;

g) information on which stages are not considered, if the declaration is not based on an LCA covering all life cycle stages;

h) a statement that EPD of construction products may not be comparable if they do not comply with this standard, see also 〈A2〉 5.3 〈A2〉;

i) in the case where an EPD is declared as an average environmental performance for a number of products a statement to that effect shall be included in the declaration together with a description of the range/ variability of the LCIA results if significant;

j) the site(s), manufacturer or group of manufacturers or those representing them for whom the EPD is representative;

k) the declaration of material content of the product shall list as a minimum substances contained in the product that are listed in the "Candidate List of Substances of Very High Concern for authorisation" when their content exceeds the limits for registration with the European Chemicals Agency;

NOTE 2 The source location of any safety data sheet can be provided.

NOTE 3 Substances of very high concern" are listed in the Candidate List of Substances of Very High Concern for Authorisation of the European Chemicals Agency.

l) information on where explanatory material may be obtained.

NOTE 4 Guidance on safe and effective installation, use and disposal of the product can be supplied.

In addition to the above-mentioned general information, Table 2 shall be completed and reproduced in the EPD.

Table 2 — Demonstration of verification

CEN standard [A1] EN 15804 [A1] serves as the core PCR [a]
[A1] Independent verification of the declaration and data [A1], according to EN ISO 14025:2010 ☐ internal ☐ external
(Where appropriate [b]) Third party verifier: <Name of the third party verifier>
[a] Product category rules. [b] Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4).

[A2] *deleted text* [A2]

7.2 Declaration of environmental [A2] indicators [A2] derived from LCA

7.2.1 General

To illustrate the product system studied, the EPD shall contain a simple flow diagram of the processes included in the LCA. They shall be sub-divided at least into the life cycle stages of the product: production, and if applicable construction, use and end-of-life (see Figure 1). The stages may be further sub-divided.

7.2.2 Rules for declaring LCA information per module

[A2] In order to support the application of the modular information of an EPD in the assessment of environmental performance of a building and other construction works, it is necessary to provide information in a modular way.

NOTE The standard EN 15978 shows how modular information from EPD is used at the building level. The standard EN 15942 provides a communication format.

The information on environmental impacts and aspects relating to modules A1–A3, C1–C4 and D shall be included in all EPD, see 5.2. Information modules that generate any input or output flows considered in the declaration of module D shall also be declared.

EXAMPLE The declaration of benefits of material and energy recovery in module D from packaging recovery in A5 is only possible if optional module A5 has been declared, including all related processes.

The EPD shall specify which EPD-type is declared (see 5.2 and Figure 1):

a) cradle to gate with modules C1–C4 and module D (A1–A3, + C + D);

b) cradle to gate with options, modules C1–C4, and module D (A1–A3 + C + D and additional modules. The additional modules may be one or more selected from A4 to B7);

c) cradle to grave and module D (A + B + C + D);

d) cradle to gate (A1–A3);

e) cradle to gate with options (A1–A3 and additional modules. The additional modules may be A4 and A5).

Modules and indicators not declared shall be marked as "ND". If an indicator value has been calculated to be "zero" or if the value of "zero" is plausible for this indicator e.g. there is no activity in the scenario, then "0" is declared for this indicator. The declaration of "-" is not allowed.

If an indicator is declared, it shall be declared in all the chosen modules. If an optional module is declared, all the chosen indicators shall be declared. ⟨A2⟩

7.2.3 ⟨A2⟩ Indicators describing environmental impacts based on Life Cycle Impact Assessment (LCIA) ⟨A2⟩

7.2.3.1 ⟨A2⟩ Core environmental impact indicators

Table 3 presents information on environmental impacts expressed with the impact category indicators of LCIA using characterisation factors. These core environmental impact indicators shall be included in each module declared in the EPD.

Table 3 — Core environmental impact indicators

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
Climate change – total [a]	Global Warming Potential total (GWP-total)	kg CO_2 eq.
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.
Climate change - biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.
Climate change - land use and land use change [b]	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	⟨AC⟩ kg P eq. ⟨AC⟩
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance	mol N eq.

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
	(EP-terrestrial)	
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP);	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals [c] [d]	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	kg Sb eq.
Depletion of abiotic resources - fossil fuels [c]	Abiotic depletion for fossil resources potential (ADP-fossil)	MJ, net calorific value
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. deprived

[a] The total global warming potential (GWP-total) is the sum (see C.2) of
— GWP-fossil
— GWP-biogenic
— GWP-luluc

[b] It is permitted to omit GWP-luluc as separate information if its contribution is < 5 % of GWP-total over the declared modules excluding module D.

[c] The abiotic depletion potential is calculated and declared in two different indicators:
— ADP-minerals&metals include all non-renewable, abiotic material resources (i.e. excepting fossil resources);
— ADP-fossil include all fossil resources and includes uranium.

[d] ultimate reserve model of the ADP-minerals&metals model

7.2.3.2 Additional environmental impact indicators

Table 4 presents information on environmental impacts expressed with the impact category indicators of LCIA using characterisation factors. These additional environmental impact indicators shall be calculated and included in the project report for each module declared and may be included in the EPD.

Table 4 shall be included in the EPD for the declared additional environmental indicators. If additional indicators are not declared, they shall be mentioned in the EPD, e.g. as an entry of "ND" to Table 4 or as text.

Table 4 — Additional environmental impact indicators

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
Particulate Matter emissions	Potential incidence of disease due to PM emissions (PM)	Disease incidence
Ionizing radiation, human health	Potential Human exposure efficiency relative to U235 (IRP)	kBq U235 eq.
Eco-toxicity (freshwater)	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	CTUe
Human toxicity, cancer	Potential Comparative Toxic Unit for	CTUh

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
effects	humans (HTP-c)	
Human toxicity, non-cancer effects	Potential Comparative Toxic Unit for humans (HTP-nc)	CTUh
Land use related impacts/ Soil quality	Potential soil quality index (SQP)	dimensionless

7.2.3.3 Disclaimers to the declaration of core and additional environmental impact indicators

Table 5 presents disclaimers which shall be declared in the project report and in the EPD with regard to the declaration of relevant core and additional environmental impact indicators according to the following classification.

Table 5 — Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD Type 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD Type 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD Type 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2
Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible		

ILCD classification	Indicator	Disclaimer
nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.		
Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.		

〈A2〉

7.2.4 〈A2〉 Indicators describing resource use and environmental information based on Life Cycle Inventory (LCI) 〈A2〉

7.2.4.1 〈A2〉 General

For improved transparency of the description of the environmental performance of construction products through the environmental impact indicators, three groups of indicators and environmental information based on LCI shall be declared. 〈A2〉

7.2.4.2 〈A2〉 Indicators describing resource use

Table 6 presents indicators describing resource use which shall be included in each module declared in the EPD. 〈A2〉

Table 〈A2〉 6 〈A2〉 — Parameters describing resource use

Parameter	Unit(expressed per functional unit or per declared unit)
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value
Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of secondary material	kg
Use of renewable secondary fuels	MJ, net calorific value
Use of non-renewable secondary fuels	MJ, net calorific value
Net use of fresh water	m^3

NOTE In order to identify the input part of renewable/non-renewable primary energy used as an energy carrier and not used as raw materials, the [A2] indicator [A2] "use of renewable/non-renewable primary energy excluding renewable/non-renewable primary energy resources used as raw materials" is considered and can be calculated as the difference between the total input of primary energy and the input of energy resources used as raw materials.

7.2.4.3 [A2] Environmental information describing waste categories

Table 7 presents indicators describing waste categories derived from LCI. They shall be included in each module declared in the EPD. [A2]

[A2] *deleted text* [A2]

Table [A2] 7 [A2] — Other environmental information describing waste categories

Parameter	Unit(expressed per functional unit or per declared unit)
Hazardous waste disposed	kg
Non-hazardous waste disposed	kg
Radioactive waste disposed	kg

NOTE The characteristics that render waste hazardous are described in existing applicable legislation, e.g. in the European Waste Framework Directive.

7.2.4.4 [A2] Environmental information describing output flows

Table 8 presents indicators describing output flows derived from LCI. They shall be included in each module declared in the EPD. [A2]

Table [A2] 8 [A2] — [A2] *deleted text* [A2] Environmental information describing output flows

[A2] Indicator [A2]	Unit (expressed per functional unit or per declared unit)
Components for re-use	kg
Materials for recycling	kg
Materials for energy recovery	kg
Exported energy	MJ per energy carrier

NOTE 1 The [A2] indicators [A2] in Table [A2] 8 [A2] are also part of the additional information for scenarios at end-of-life, see 7.3.4, [A2] Table 15 [A2].

NOTE 2 The [A2] indicators [A2] in Table [A2] 8 [A2] are calculated on the gross amounts leaving the system boundary when they have reached the end-of-waste state as described in Annex B.

NOTE 3 The declaration of "components for re-use" and "materials for recycling": fulfils the conditions of [A2] 6.3.5.5 [A2], end-of-life stage.

NOTE 4 The [A2] indicators [A2] "Materials for energy recovery" does not include materials for waste incineration. Waste incineration is a method of waste processing and is allocated within the system boundaries. Waste incineration plants have a lower energy efficiency rate than power stations using secondary fuels. Materials for energy recovery are based on thermal energy efficiency rate of the a power station not less than 60 % or 65 % for installations after 31st of December 2008 in order to be in line with the distinction made by the EC.

NOTE 5 Exported energy relates to energy exported from waste incineration and landfill.

7.2.5 [A2] Information on biogenic carbon content

Table 9 presents information on biogenic carbon content which shall be included in the EPD as follows:

Table 9 — Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit (expressed per functional unit or per declared unit)
Biogenic carbon content in product	kg C
Biogenic carbon content in accompanying packaging	kg C
NOTE 1 kg biogenic carbon is equivalent to 44/12 kg of CO_2.	

If the mass of biogenic carbon containing materials in the product is less than 5 % of the mass of the product, the declaration of biogenic carbon content may be omitted.

If the mass of biogenic carbon containing materials in the packaging is less than 5 % of the total mass of the packaging, the declaration of the biogenic carbon content of the packaging may be omitted. ⟨A2⟩

7.3 Scenarios and additional technical information

7.3.1 General

Scenarios for certain life cycle stages should support the application of product related data in the corresponding life cycle stage of the building assessment.

Additional technical information as defined in 7.3, Table [A2] 10 ⟨A2⟩ to [A2] Table 15 ⟨A2⟩ supports the consistent development of scenarios by which the LCA derived [A2] indicators ⟨A2⟩ [A1] defined in [A2] 7.2.3 and 7.2.4 ⟨A2⟩ ⟨A1⟩ [A2] *deleted text* ⟨A2⟩ are calculated and declared. [A2] *deleted text* ⟨A2⟩

If an EPD claims to cover all life cycle stages, [A2] all relevant mandatory and optional modules ⟨A2⟩ shall be calculated for specified scenarios and the LCA derived [A2] indicators ⟨A2⟩ shall be declared.

[A2] For an EPD covering cradle to gate with options, modules C1–C4, and module D (A1–A3 + C + D and additional modules where the optional modules may be A4 and/or A5 and/or any of B1–B7), the optional modules are calculated and the LCA derived indicators are declared. Alternatively, in this type of EPD, a manufacturer may choose to declare additional technical information without calculating the optional life cycle stages to ensure proper understanding of a product's function in a building and thus support proper scenario development at the building level. ⟨A2⟩

Additional technical information is declared in the module, to which it refers (e.g. technical information about the use of a product in the appropriate use stage modules B.)

Any additional technical information shall be documented separately from the LCA derived [A2] indicators ⟨A2⟩.

If additional technical information is not complete at the product level as specified in 7.3, this shall be stated.

[A2] The information in Tables 10 to 15 is not exhaustive ⟨A2⟩ with respect to the examples or units and [A2] scenario information ⟨A2⟩ given.

7.3.2 Construction process stage

7.3.2.1 A4, Transport to the building site

If additional technical information is provided in the EPD for transport from the production gate to the construction site, the following information shall be provided to specify the transport scenarios used or to support development of the scenarios at the building level:

Table [A2] 10 [A2] — Transport to the building site

[A2] Scenario information [A2]	Unit (expressed per functional unit or per declared unit)
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat etc.	Litre of fuel type per distance or vehicle type, Commission Directive 2007/37/EC (European Emission Standard)
Distance	km
Capacity utilisation (including empty returns)	%
Bulk density of transported products	kg/m^3
Volume capacity utilisation factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaged products)	Not applicable

NOTE 1 As an alternative to the bulk density the weight and volume of transported products may be specified.

NOTE 2 With the bulk density and the volume capacity utilisation factor, (complex) logistic scenarios (e.g. taking onto account the type of vehicle, transport distance, empty returns) at the building level can be considered.

NOTE 3 For the assessment at the building level more complex logistics may have to be considered.

7.3.2.2 A5, Installation in the building

If additional technical information is provided in the EPD for installation in the building, the following information shall be provided to specify the product's installation scenarios or to support development of the scenarios describing the product's installation at the level of the building assessment:

Table [A2] 11 [A2] — Installation of the product in the building

[A2] Scenario information [A2]	Unit (expressed per functional unit or per declared unit)
Ancillary materials for installation (specified by material);	kg or other units as appropriate
Water use	m^3
Other resource use	kg
Quantitative description of energy type (regional mix) and consumption during the installation process	kWh or MJ

[A2] Scenario information [A2]	Unit (expressed per functional unit or per declared unit)
Waste materials on the building site before waste processing, generated by the product's installation (specified by type)	kg
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	kg
Direct emissions to ambient air, soil and water	kg

7.3.3 B1-B7 use stage

7.3.3.1 B1-B5 use stage related to the building fabric

B1: Environmental aspects and impacts connected to the normal (i.e. anticipated) use of products, not including those related to energy and water use, which are dealt with in B6 and B7) e.g. release of substances from the facade, roof, floor covering, walls and other surfaces (interior or exterior) are reported as additional information (see 7.4).

B2-B5, if additional technical information is provided in the EPD for products requiring maintenance, repair, replacement, refurbishment the following information shall be provided to specify the scenarios or to support the development scenarios of these modules at the building level. Information given for Table [A2] 12 [A2] shall be consistent with the [A2] RSL [A2] data given in Table [A2] 13 [A2]:

Table [A2] 12 [A2] — Use stage related to the building fabric

[A2] Scenario information [A2]	Unit (expressed per functional unit or per declared unit)
B2 Maintenance	
Maintenance process	Description or source where description can be found
Maintenance cycle	Number per RSL or year [a]
Ancillary materials for maintenance, e.g. cleaning agent, specify materials	kg / cycle,
Waste material resulting from maintenance (specify materials)	kg
Net fresh water consumption during maintenance	m^3
Energy input during maintenance, e.g. vacuum cleaning, energy carrier type, e.g. electricity, and amount, if applicable and relevant	kWh
B3 Repair	
Repair process	Description or source where description can be found

[A2] Scenario information [A2]	Unit (expressed per functional unit or per declared unit)
Inspection process	Description or source where description can be found
Repair cycle	Number per RSL or year
Ancillary materials, e.g. lubricant, specify materials	kg or kg / cycle
Waste material resulting from repair, (specify materials)	kg
Net fresh water consumption during repair	m^3
Energy input during repair, e.g. crane activity, energy carrier type, e.g. electricity, and amount	kWh / RSL, kWh / cycle
B4 Replacement	
Replacement cycle	Number per RSL or year
Energy input during replacement e.g. crane activity, energy carrier type, e.g. electricity and amount if applicable and relevant	kWh
Exchange of worn parts during the product's life cycle, e.g. zinc galvanised steel sheet, specify materials	kg
B5 Refurbishment	
Refurbishment process	Description or source where description can be found
Refurbishment cycle	Number per RSL or year
Energy input during refurbishment e.g. crane activity, energy carrier type, e.g. electricity, and amount if applicable and relevant	kWh
Material input for refurbishment, e.g. bricks, including ancillary materials for the refurbishment process e.g. lubricant, (specify materials)	kg or kg / cycle
Waste material resulting from refurbishment (specify materials)	kg
Further assumptions for scenario development, e.g. frequency and time period of use, number of occupants	Units as appropriate

[a] Not applicable if only B2 is declared.

7.3.3.2 Reference service life

The description of the [A2] RSL [A2] (see also Annex A) may be based on data collected as average data or at the beginning or end of the service life. The [A2] reference in-use conditions [A2] for achieving the declared technical and functional performance and the declared [A2] RSL [A2] shall include the [A2] RSL [A2] data as described in Table [A2] 13 [A2], where relevant:

Table [A2] 13 [A2] — Reference Service Life

[A2] RSL information [A2]	Unit (expressed per functional unit or per declared unit)
Reference Service Life	Years
Declared product properties (at the gate) and finishes, etc.	Units as appropriate
Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes	Units as appropriate
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Units as appropriate
Outdoor environment, (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature	Units as appropriate
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	Units as appropriate
Usage conditions, e.g. frequency of use, mechanical exposure	Units as appropriate
Maintenance e.g. required frequency, type and quality and replacement of components	Units as appropriate

7.3.3.3 B6, use of energy and B7, use of water

If additional technical information is provided in the EPD for building integrated technical systems using energy or water related to the operation of the building, the following information shall be provided to specify the scenarios or to support the development of the use of energy and use of water scenarios at the building level:

Table [A2] 14 [A2] — Use of energy and use of water

[A2] Scenario information [A2]	Unit (expressed per functional unit or per declared unit)
Ancillary materials specified by material	kg or units as appropriate
Net fresh water consumption	m^3
Type of energy carrier, e.g. electricity, natural gas, district heating	kWh
Power output of equipment	kW
Characteristic performance, e.g. energy efficiency, emissions, variation of performance with capacity utilisation etc.	units as appropriate
Further assumptions for scenario development, e.g. frequency and period of use, number of occupants	units as appropriate

[A2] *deleted text* [A2]

7.3.4 End-of-life

If additional technical information is provided in the EPD about end-of-life processes, the following information shall be provided for all construction products to specify the end-of-life scenarios used or to support development of the end-of-life scenarios at the building level. Scenarios shall only model processes e.g. recycling systems that have been proven to be economically and technically viable.

Table [A2] 15 [A2] — End-of-life

Processes	Unit (expressed per functional unit or per declared unit of components products or materials and by type of material)
Collection process specified by type	kg collected separately
	kg collected with mixed construction waste
Recovery system specified by type	kg for re-use
	kg for recycling
	kg for energy recovery
Disposal specified by type	kg product or material for final deposition
Assumptions for scenario development, e.g. transportation	units as appropriate

7.4 Additional information on release of dangerous substances to indoor air, soil and water during the use stage

7.4.1 Indoor air

The following information shall be provided for products exposed to indoor air after their installation in buildings during the use stage in order to support use stage scenarios with respect to health at the building level:

— Emissions to indoor air, according to the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised testing methods according to the provisions of the respective Technical Committees for European product standards, when available.

NOTE The EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

7.4.2 Soil and water

The following information shall be provided for products exposed to soil and water after their installation in buildings during the use stage in order to support use stage scenarios for soil and water pollution at the building level:

— Release to soil and water according to the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised testing methods according to the provisions of the respective Technical Committees for European product standards, when available.

NOTE The EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

7.5 Aggregation of information modules

The indicators declared in the individual information modules of a product life cycle A1 to A5, B1 to B7, C1 to C4 and module D as described in Figure 1 shall not be added up in any combination of the individual information modules into a total or sub-total of the life cycle stages A, B, C or D. As an exception information modules A1, A2, and A3 may be aggregated.

8 Project report

8.1 General

The project report is the systematic and comprehensive summary of the project documentation supporting the verification of an EPD. The project report shall record that the LCA based information and the additional information as declared in the EPD meet the requirements of this European Standard. It shall be made available to the verifier with the requirements on confidentiality stated in EN ISO 14025.

The project report is not part of the public communication.

The project report should contain any data and information of importance for the data published in the EPD and as required in this European Standard. Special care is necessary to demonstrate in a transparent way how the data and information declared in the EPD results from the LCA study and how the reference RSL has been established.

[A2] The project report shall include the results of all environmental impact indicators. [A2]

NOTE In this context project means the LCA study on the declared product.

8.2 LCA-related elements of the project report

The results, data, methods, assumptions and limitations and conclusions of the LCA shall be completely and accurately reported without bias. They shall be transparent and presented in sufficient detail to allow independent verification and to permit an understanding of the complexities and trade-offs inherent in the LCA. The report should also allow the results and interpretation to be used in support of the data and additional information made available in the respective EPD.

The project report shall give the following:

a) General aspects:

   1) commissioner of the LCA study, internal or external practitioner of the LCA study;

   2) date of report;

   3) statement that the study has been conducted according to the requirements of this standard;

b) Goal of the study:

   1) reasons for carrying out the study and its intended application and audience, i.e. providing information and data for an EPD for business-to-business and/or business-to-consumer communication;

c) Scope of the study:

   1) declared/functional unit, including:

      i) definition, including relevant technical specification(s);

      ii) calculation rule for averaging data e.g. when the declared/functional unit is defined for:

         1. a group of similar products produced by different suppliers or

         2. the same product produced at different production sites;

   2) system boundary according to the modular approach as outlined in Figure 1, including:

      i) omissions of life cycle stages, processes or data needs;

      ii) quantification of energy and material inputs and outputs, taking into account how plant-level data is allocated to the declared products;

      iii) assumptions about electricity production and other relevant background data;

      iv) [A2] assumptions about the system boundaries should be included where relevant including how the net impacts are calculated in module D (see 6.4.3.3 and D.3.4); [A2]

   3) cut-off criteria for initial inclusion of inputs and outputs, including:

      i) description of the application of cut-off criteria and assumptions;

      ii) list of excluded processes;

d) Life cycle inventory analysis:

1) qualitative/quantitative description of unit processes necessary to model the life cycle stages of the declared unit, taking into account the provisions of EN ISO 14025 regarding data confidentiality;

2) [A2] an overview should be given of the transfers, emissions, and removals of biogenic carbon in the different modules, between the system under study, nature and other product systems and of the biogenic carbon content of the functional or declared unit at factory gate (see 6.4.4, Table 9 and C.2); [A2]

3) sources of generic data or literature used to conduct the LCA;

4) validation of data, including:

i) data quality assessment;

ii) treatment of missing data;

4) allocation principles and procedures, including:

i) documentation and justification of allocation procedures;

ii) uniform application of allocation procedures;

e) Life cycle impact assessment:

1) [A2] the LCIA procedures, calculations and results of the study including all additional environmental impact indicator results; [A2]

2) the relationship of the LCIA results to the LCI results;

3) reference to all characterization models, characterization factors and methods used, as defined in this European Standard;

4) a statement that the LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks;

f) Life cycle interpretation:

1) the results;

2) [A2] assumptions and limitations associated with the interpretation of results as declared in the EPD and for the results of the additional impact indicators, both methodology and data related; [A2]

3) the variance from the means of LCIA results should be described, if generic data are declared from several sources or for a range of similar products;

4) data quality assessment;

5) full transparency in terms of value-choices, rationales and expert judgements.

8.3 Documentation on additional information

The project report shall include any documentation on additional environmental information declared in the EPD as required in this standard. Such documentation on additional environmental information may include, e.g. as copies or references:

— laboratory results/measurements for the content declaration;

— laboratory results/measurement of functional/technical performance;

— documentation on declared technical information on life cycle stages that have not been considered in the LCA of the construction product and that will be used for the assessment of buildings (e.g. transport distances, RSL according to Annex A, energy consumption during use, cleaning cycles, etc.);

— laboratory results/measurements for the declaration of emissions to indoor air, soil and water during the product's use stage.

8.4 Data availability for verification

To facilitate verification it is considered good practice to make the following information available to the verifier, taking into account data confidentiality according to [A2] ISO 21930:2017, 10.3 [/A2]:

— analysis of material and energy flows to justify their inclusion or exclusion;

— quantitative description of unit processes that are defined to model processes and life cycle stages of the declared unit;

— attribution of process and life cycle data to datasets of an LCA-software (if used);

— LCIA results per modules of unit processes, e.g. structured according to life cycle stages;

— LCIA results per production plant/product if generic data is declared from several plants or for a range of similar products;

— documentation that substantiates the percentages or figures used for the calculations in the end-of-life scenario;

— documentation that substantiates the percentages and figures (number of cycles, prices, etc.) used for the calculations in the allocation procedure, if it differs from the PCR.

9 Verification and validity of an EPD

After verification an EPD is valid for a 5 year period from the date of issue, after which it shall be reviewed and verified. An EPD shall only be reassessed and updated as necessary to reflect changes in technology or other circumstances that could alter the content and accuracy of the declaration. An EPD does not have to be recalculated after 5 years, if the underlying data has not changed significantly.

The process for verification and establishing the validity of an EPD shall be in accordance with EN ISO 14025 and ISO 21930.

NOTE A reasonable change in the environmental performance of a product to be reported to the verifier is +/- 10% on any one of the declared [A2] indicators [/A2] of the EPD (see Clause 7). Such a change may require an update of the EPD.

Annex A
(normative)

Requirements and guidance on the reference service life

[A2] A declared reference service life (RSL) shall be related to the declared functional and technical performance and to any maintenance or repair necessary to sustain the declared performance during the declared RSL. The declared functional and technical performance may be based on specifications for determination or calculation of this performance given in relevant harmonized European Standards. Levels of performance may be defined as initial, average or minimum levels (see Figures A.1 and A.2). [A2]

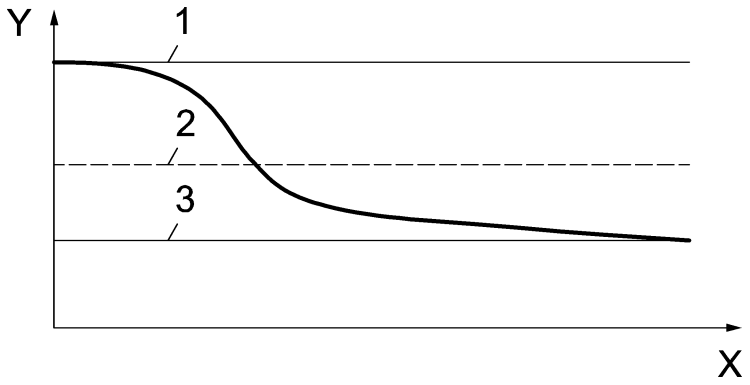
[A2] NOTE 1A manufacturer or producer of the construction product cannot be held responsible for the actual design of the building and the use and application of the product, the actual environmental conditions or the workmanship. [A2]

[A2] The RSL of a product can be based upon empirical, probabilistic, statistical, deemed to satisfy or research (scientific) data and shall always taking into account the intended use (description of use), see ISO 15686-1, -2, -7 and -8. This basis shall be mentioned in the EPD. [A2]

[A2] *deleted text* [A2]

[A2] NOTE 2 [A2] The declared technical performance may be the input for calculations beyond this standard. However the out-come in terms of RSL will be input for the requirements in this standard.

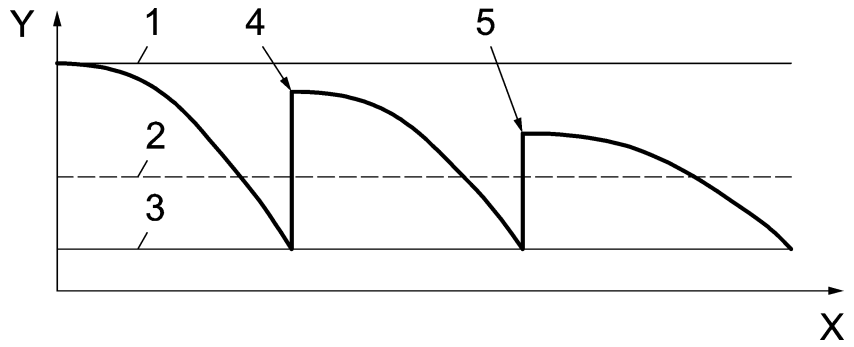
EXAMPLE The thermal performance of a window, insulation, a heating boiler, etc. will impact on the energy use of the building in the use stage. This energy use, its emissions and waste are contributing to the environmental aspects and impacts of the building in the use stage. The RSL of the window, insulation, the heating boiler, etc. needs to be linked to the product's performance in order to provide consistency in the calculation model.



Key

X	RSL
Y	functional performance
1	initial
2	average
3	minimum

Figure A.1 — Type of declared technical and functional performance and RSL



Key

X	RSL
Y	technical and functional performance
1	initial
2	average
3	minimum
4	maintenance/ repair
5	maintenance/ repair

Figure A.2 — Type of declared technical and functional performance, repair/maintenance during RSL

The RSL is dependent on the properties of the product and specific in-use conditions. These conditions shall be declared together with a RSL and it shall be stated that the RSL only applies to these specific ▌A2⟩ in-use conditions ⟨A2▐.

The description of the technical and functional performance of a product is required for the European technical specifications for construction products. This description may be based on data collected as average data or at the beginning or end of the service life. The reference ▌A2⟩ in-use conditions ⟨A2▐ for achieving the declared technical and functional performance and the declared ▌A2⟩ RSL ⟨A2▐ shall include the following, where relevant:

— declared product properties (at the gate) and those of any finishes, etc.;

— design application parameters (if instructed by the manufacturer), including references to any appropriate requirements and application codes;

— an assumed quality of work,;

— external environment, (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature;

— internal environment (for indoor applications), e.g. temperature, moisture, chemical exposure;

— usage conditions, e.g. frequency of use, mechanical exposure;

— maintenance, e.g. required frequency, type and quality and replacement of replaceable components.

In many cases the Estimated Service Life (ESL) of the building depends on whether its components are replaceable or repairable. Normally the ESL of a building depends on the service life of the load bearing product or construction element which is not replaceable or repairable.

The RSL of a construction element (e.g. a window) declared in the EPD is dependent on the service life of its individual components (handle, hinge, etc.) and may be determined by the component with the

lowest service life. It also depends on whether the single components of the construction element are replaceable or repairable.

RSL data is normally based on direct testing or both direct and indirect data acquisition (see ISO 15686-2, ISO 15686-8 and ISO/TS 15686-9 and "Guidance Paper F, Durability and the Construction Products Directive"). Direct data acquisition may be based on:

— field exposure;

— inspection of buildings and their components;

— experimental buildings;

— in-use exposure.

In some cases for products for which direct data are not available indirect methods may be used for establishing RSL:

— correlated to data for existing products of a similar type with similar functions having similar use and exposure conditions;

— comparative data obtained by testing the products of a similar type and similar function for similar uses and exposure conditions, in accordance with EN product test standards.

〚A2〛 NOTE 3 〈A2〉 ISO/TS 15686-9 refers to procedures that may be divided into two groups, direct and indirect tests.

Direct testing – the achievement of a certain level of performance in a test of a particular property is recognised as being direct evidence of expected service life (e.g. abrasion, fatigue, closing, and impact tests).

Indirect (proxy) testing – the measurement of “proxy” characteristics that can be correlated to actual performance and hence service life (e.g. porosity for freeze-thaw resistance and hardness for abrasion resistance).

Tests may be either:

— Natural weathering/ageing tests, which either give a direct indication of service life (e.g. corrosion tests) or enable normal performance tests to be carried out after treatment, thus allowing the likely degradation under in-use conditions to be determined;

— Accelerated weathering/ageing tests, in which the normal ageing process is speeded up to reduce the duration of the test. Care is needed to ensure that degradation mechanisms are just accelerated and not significantly altered in such tests.

Tests may be long-term or short-term, or a combination of both.

Long-term tests may include:

a) field exposure;

b) exposure in experimental buildings.

Short-term tests may include:

c) accelerated short-term tests;

d) short-term in-use exposures.

Annex B
(informative)

Waste

B.1 End-of-waste

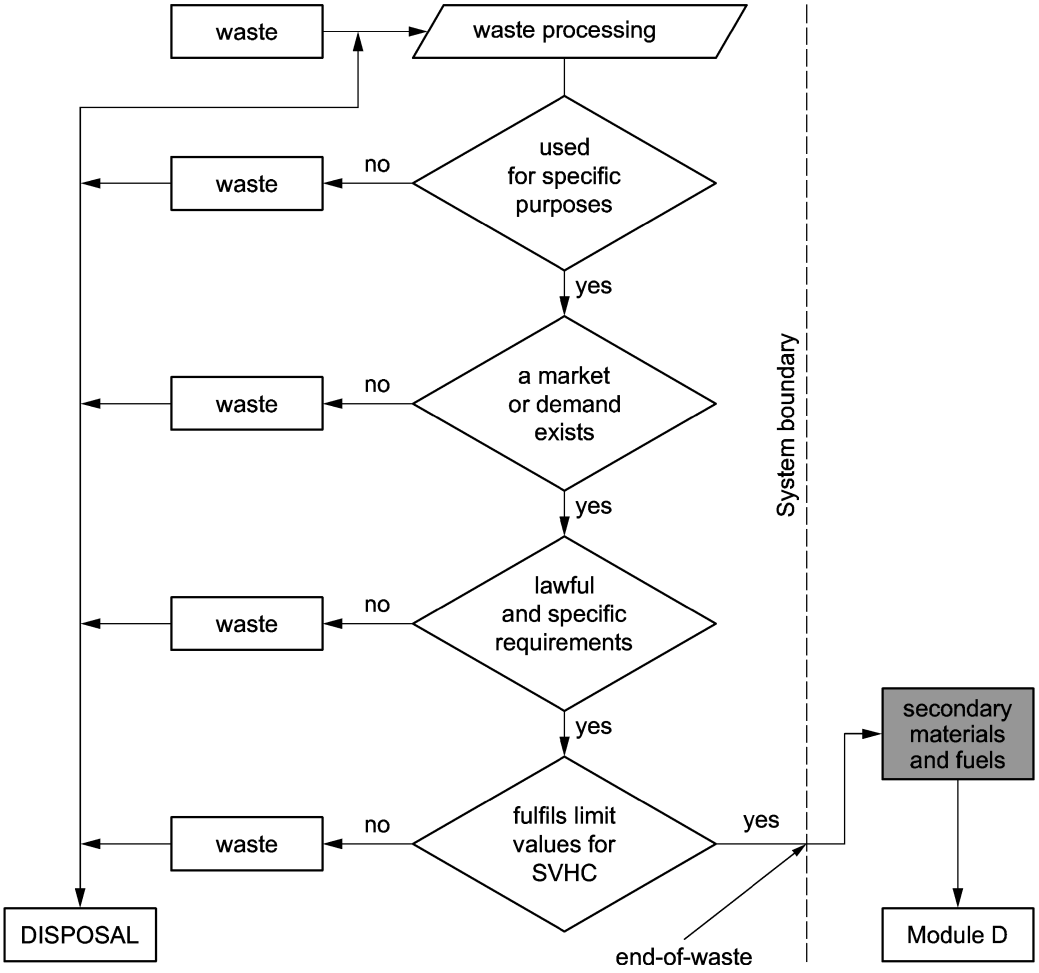


Figure B.1 — Decision-tree for end-of-waste

B.2 Properties of hazardous waste for Table [A2] 8 [A2]

The characteristic that render waste hazardous are described in existing applicable legislation, e.g. in the European Waste Framework Directive.

[A2]

Annex C
(normative)

Impact categories and related indicators, methodologies and characterization factors (CF)

C.1 Core environmental impact categories and indicators

Table C.1 — Core environmental indicators, units and models

Impact Category	Indicator	Unit	Model
Climate change – total [a]	Global Warming Potential total (GWP-total)	kg CO_2 eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
Climate change - biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
Climate change - land use and land use change[b]	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.	Baseline model of 100 years of the IPCC based on IPCC 2013
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	Steady-state ODPs, WMO 2014
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	▌AC〉 kg P eq. 〈AC▐	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-marine)	kg N eq.	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	mol N eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP);	kg NMVOC eq.	LOTOS-EUROS ,Van Zelm et al., 2008, as applied in ReCiPe
Depletion of abiotic resources - minerals	Abiotic depletion potential for non-fossil	kg Sb eq.	CML 2002, Guinée et al., 2002, and van

Impact Category	Indicator	Unit	Model
and metals[c d]	resources (ADP-minerals&metals)		Oers et al. 2002.
Depletion of abiotic resources - fossil fuels[c]	Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. deprived	Available WAter REmaining (AWARE) Boulay et al., 2016

[a] The total global warming potential (GWP-total) is the sum (see C.2) of
— GWP-fossil
— GWP-biogenic
— GWP-luluc.

[b] It is permitted to omit GWP-luluc as separate information if its contribution is < 5 % of GWP-total over the declared modules excluding module D.

[c] The abiotic depletion potential is calculated and declared in two different indicators:
— ADP-minerals&metals include all non-renewable, abiotic material resources (i.e. excepting fossil resources);
— ADP-fossil includes all fossil resources and includes uranium.

[d] ultimate reserve model of the ADP-minerals&metals model.

C.2 Calculation rules for the climate change impact category

C.2.1 General

The impact category of climate change is declared as global warming potential.

C.2.2 Total global warming potential (GWP-total)

The total global warming potential (GWP-total) is the sum of three sub-categories of climate change. The three sub-categories shall be declared separately as described in 7.2.3.1.

C.2.3 Fossil global warming potential (GWP-fossil)

This indicator accounts for GWP from greenhouse gas emissions and removals to any media originating from the oxidation or reduction of fossil fuels or materials containing fossil carbon by means of their transformation or degradation (e.g. combustion, incineration, landfilling, etc.). This indicator also accounts for GWP from GHG emissions e.g. from peat and calcination as well as GHG removals e.g. from carbonation of cement-based materials and lime.

C.2.4 Biogenic global warming potential (GWP-biogenic)

This indicator accounts for GWP from removals of CO_2 into biomass from all sources except native forests, as transfer of carbon, sequestered by living biomass, from nature into the product system declared as GWP-biogenic. This indicator also accounts for GWP from transfers of any biogenic carbon from previous product systems into the product system under study.

This indicator also covers biogenic emissions to air from biomass from all sources except native forests due to oxidation or degradation (e.g. combustion, solid waste disposal) as well as all transfers of biogenic carbon from biomass from all sources except native forests into subsequent product systems in the form of biogenic CO_2.

All carbon exchanges through the lifecycle (modules A to modules C) relating to biogenic carbon content in biomass from native forests shall be modelled under GWP-luluc according to the latest available version of PEF Guidance document.

NOTE 1 Native forests exclude short term forests, degraded forests, managed forest, and forests with short-term or long-term rotations.

Impacts are declared in the modules where they occur.

Removals of biogenic CO_2 into biomass (with the exclusion of biomass of native forests) and transfers from previous product systems shall be characterised in the LCIA as –1 kg CO_2 eq./kg CO_2 when entering the product system. Emissions of biogenic CO_2 from biomass and transfers of biomass into subsequent product systems (with the exclusion of biomass of native forests) shall be characterized as +1 kg CO_2 eq./kg CO_2 of biogenic carbon, see EN ISO 14067:2018, 6.5.2.

NOTE 2 The amount of CO_2 taken up in biomass and the equivalent amount of CO_2 emissions from the biomass at the point of complete oxidation results in zero net CO_2 emissions when biomass carbon is not converted into methane, non-methane volatile organic compounds (NMVOC) or other precursor gases.

C.2.5 Land use and land use change global warming potential (GWP-luluc)

This indicator accounts for GHG emissions and removals (CO_2, CO and CH_4) originating from changes in the defined carbon stocks caused by land use and land use changes associated with the declared/functional unit. This indicator includes biogenic carbon exchanges resulting e.g. from deforestation or other soil activities (including soil carbon emissions). Calculation rules for GWP-luluc shall follow the latest available version of PEF Guidance document. For native forests, all related CO_2 emissions are included and modelled under this sub-category (including connected soil emissions, products derived from native forest and residues). CO_2 uptake related to the carbon content of biomass entering the product system from native forests is set to zero. Impacts are declared in the modules where they occur.

Any biomass-based net increase in carbon stocks, including soil carbon uptake (accumulation), shall not be considered in GWP-luluc, and is set to zero. Soil carbon storage may be included as additional environmental information when proof is provided.

NOTE For example proof of soil carbon storage is provided when legislation provides modelling requirements for the sector such as the EU greenhouse gas accounting rules from 2013 (Decision 529/2013/EU), which indicate carbon stock accounting.

GWP-luluc shall be included in GWP-total. If the contribution of GWP-luluc is < 5 % of GWP-total over the declared modules excluding module D, GWP-luluc may be provided as indicator not declared (ND).

C.3 Additional impact categories and indicators

Table C.2 — Indicators, units and models for additional impact categories

Impact category	Indicator	Unit	Model
Particulate matter emissions	Potential incidence of disease due to PM emissions (PM)	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ionising radiation, human health	Potential Human exposure efficiency relative to U235 (IRP)	kBq U235 eq.	Human health effect model as developed by Dreicer et al. 1995 update by Frischknecht et al., 2000
Ecotoxicity (freshwater)	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	CTUe	Usetox version 2 until the modified USEtox model is available from EC-JRC
Human toxicity, cancer effects	Potential Comparative Toxic Unit for humans (HTP-c)	CTUh	Usetox version 2 until the modified USEtox model is available from EC-JRC
Human toxicity, non-cancer effects	Potential Comparative Toxic Unit for humans (HTP-nc)	CTUh	Usetox version 2 until the modified USEtox model is available from EC-JRC
Land use related impacts / soil quality	Potential Soil quality index (SQP)	dimensionless	Soil quality index based on LANCA

C.4 Characterization factors

For all indicators mentioned in this Annex C, the characterization factors from EC-JRC shall be applied. The characterization factors are available at the following web-link:

http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml .

The characterization factors are available both in ILCD structure and as Excel file and they are identified by the name EN_15804. 〈A2〉

〈A2〉

Annex D
(informative)

End of life formulae

D.1 Introduction

In case of different interpretations between the annex and the text of the standard, it is the text of the standard which prevails on the information in this annex.

This annex provides end of life formulae for each module of the environmental assessment of construction products. Formulae used, should be from this annex.

D.2 Terms and definitions

D.2.1 Value correction factor

Parameter *Q* represents the quality of the material:

$Q_{R\,out}$ quality of the outgoing recovered material (recycled and reused), i.e. quality of the recycled material at the point of substitution;

Q_{Sub} quality of the substituted material, i.e. quality of primary material or quality of the average input material if primary material is not used;

$Q_{R\,out} / Q_{Sub}$ quality ratio between outgoing recovered material (recycled and reused) and the substituted material.

D.2.2 Quantities

Parameter *M* represents the amount of material used for each material flow.

For every parameter *M* and *E* need to be coherent and defined at the same place (input or output) in the life cycle and for the same unit of analysis.

$M_{VM\,in}$ amount of input material to the product system that has been obtained from primary materials;

$M_{MR\,in}$ amount of input material to the product system that has been recovered (recycled or reused) from a previous system (determined at the system boundary);

$M_{MR\,out}$ amount of material exiting the system that will be recovered (recycled and reused) in a subsequent system. This amount is determined at end-of-waste point and is therefore equal to the output flow of "materials to recycling [kg]" reported for modules A4, A5, B and C;

$M_{ER\,in}$ amount of material entering the product system that has reached the end-of-waste state before incineration in a previous system and enters the product system as secondary fuel. This amount equals the output flow of "materials for energy recovery [kg]" of a previous system;

$M_{ER\,out}$ amount of material leaving the product system where it has reached the end-of-waste state before incineration and leaves the product system as secondary fuel. This amount equals to the value reported for the indicator output flow of "materials for energy recovery [kg]";

$M_{INC\,in}$ amount of waste generated by a previous system that has been incinerated with efficiency of energy recovery lower than 60 % or that is used for energy recovery with energy efficiency

greater than 60 % but has not reached the end-of-waste state;

$M_{INC\ out}$ amount of waste that will be incinerated with efficiency of energy recovery lower than 60 % or that is used for energy recovery with energy efficiency greater than 60 % but which has not reached the end-of-waste state;

M_{LF} amount of material in the product that will be landfilled.

D.2.3 Specific emissions and resources per unit of analysis

Parameter *E* represents the specific emissions and resources consumed per unit of analysis. It is calculated for each impact category according to the relevant indicator (i.e. Global warming potential, GWP). It is expressed in the units defined for the indicator (i.e. for GWP in kg CO_2 eq./kg).

For every parameter *M* and *E* need to be coherent and defined at the same place (input or output) in the life cycle and for the same unit of analysis. The emissions and resources represented by each parameter should be documented by describing the processes included. This includes describing where the system boundary for waste, secondary material and secondary fuel, both entering module A and exiting module C, starts and ends. Significant choices relating to the emissions and resources should be described in the EPD, including:

1. The point at which non-elementary inputs to modules A1–A3 are considered a waste, secondary material, secondary fuel or a co-product from another production process, and assigning of emissions;

2. The point at which non-elementary outputs from modules A5–C4 are considered a waste, secondary material, or secondary fuel, and assigning of emissions;

3. Assumptions for calculating emission removal processes in any module;

4. The allocation procedures used to assign impact to any pre-consumer wastes recovered from a previous system;

5. The calculation of net flows of secondary materials for consideration in module D.

$E_{VM\ in}$ specific emissions and resources consumed per unit of analysis arising from acquisition and pre-processing of primary material in the production of the product

$E_{VMSub\ out}$ specific emissions and resources consumed per unit of analysis arising from acquisition and pre-processing of the primary material, or average input material if primary material is not used, from the cradle to the point of functional equivalence where it would substitute secondary material that would be used in a subsequent system

$E_{MR\ before\ EoW\ out}$ specific emissions and resources consumed per unit of analysis arising from material recovery (recycling and reusing) processes of the current system until the end-of-waste state is reached

$E_{MR\ after\ EoW\ in}$ specific emissions and resources consumed per unit of analysis arising from material recovery (recycling and reusing) processes of the previous system after the end-of-waste state

$E_{MR\ after\ EoW\ out}$ specific emissions and resources consumed per unit of analysis arising from material recovery (recycling and reusing) processes of a subsequent system after the end-of-waste state

$E_{ER\ before\ EoW\ out}$ specific emissions and resources consumed per unit of analysis arising from processing of waste destined to be used as material for energy recovery of a subsequent system before the end-of-waste state (after this processing, waste is no

	longer considered as waste but as secondary fuel)
$E_{ER\ after\ EoW\ in}$	specific emissions and resources consumed per unit of analysis arising from combustion of secondary fuel entering from a previous system (having reached the end-of-waste state)
$E_{ER\ after\ EoW\ out}$	specific emissions and resources consumed per unit of analysis arising from processing and combustion of secondary fuels in a subsequent system after the-end-of-waste state (where waste is no longer considered as waste but as secondary fuel)
E_{INC}	specific emissions and resources consumed per unit of analysis arising from incineration of waste
E_{LF}	specific emissions and resources consumed per unit of analysis arising from landfill
$E_{SE\ heat}$	specific emissions and resources consumed per unit of analysis that would have arisen from specific current average substituted energy source: heat
$E_{SE\ elec}$	specific emissions and resources consumed per unit of analysis that would have arisen from specific current average substituted energy source: electricity
$E_{ER\ average}$	specific emissions and resources per unit of analysis that would have arisen from specific current average substituted energy source: heat and electricity

$$LHV \cdot X_{\mathrm{ER\ heat}} \cdot E_{\mathrm{SE\ heat}} + LHV \cdot X_{\mathrm{ER\ elec}} \cdot E_{\mathrm{SE\ elec}} \quad \text{(D.1)}$$

D.2.4 Specific emissions and resources per unit of analysis of outputs

Parameter *e* represents the specific emissions and resources consumed per unit of outputs. It is calculated for each impact category according to the relevant indicator (i.e. Global warming potential, GWP). It is expressed in the units defined for the indicator (i.e. for GWP in kg CO_2 eq.).

e_{PE}	specific emissions and resources per unit of output arising from energy consumption coming from primary sources
$e_{module\ A}$	specific emissions and resources per unit of output for modules A1–A3
$e_{module\ A}^{*}$	specific emissions and resources per unit of output for modules A1–A3 including incineration and co-incineration of waste (gross value)
$e_{module\ C}$	specific emissions and resources per unit of output for module C
$e_{module\ D}$	specific loads and benefits per unit of output for module D
$e_{module\ D1}$	specific loads and benefits per unit of analysis for module D related to the export of secondary materials
$e_{module\ D2}$	specific loads and benefits per unit of analysis for module D related to the export of secondary fuels
$e_{module\ D3}$	specific loads and benefits per unit of output for module D related to the export of energy as a result of waste incineration (for $R_1 < 60\ \%$ and $R_1 > 60\ \%$)
$e_{module\ D4}$	specific loads and benefits per unit of output for module D related to the export of energy as a result of landfilling

D.2.5 Efficiency

Parameter *X* represents the efficiency of the energy process. This parameter can take values between 0 and 1 and it is dimensionless.

$X_{ER\ heat}$ efficiency of the energy recovery process for heat

$X_{ER\ elec}$ efficiency of the energy recovery process for electricity

$X_{INC\ heat}$ efficiency of the incineration process for heat

$X_{INC\ elec}$ efficiency of the incineration process for electricity

$X_{LF\ heat}$ efficiency of the landfilling process for heat

$X_{LF\ elec}$ efficiency of the landfilling process for electricity

D.2.6 Lower heating value

Parameter LHV represents the lower heating value of the material. It is expressed in relation to the unit of analysis (e.g. J/kg).

LHV lower heating value of the material

D.3 Formulae

D.3.1 General

The calculation of the emissions and resources consumed per unit of analysis for each module A, C and D is expressed in the formulae.

D.3.2 Modules A1–A3

The applicable formula for the calculation of the emissions and resources consumed related to material resources and energy per unit of analysis for module A is the following:

$$e_{module\ A} = e_{PE} + M_{VM\ in} \cdot E_{VM\ in} + M_{MR\ in} \cdot E_{MR\ after\ EoW\ in} + M_{ER\ in} \cdot E_{ER\ after\ EoW\ in} \quad \text{(D.2)}$$

Where the first term covers the impacts related to primary energy inputs, the second term covers the impacts related to material primary inputs; the third term covers the impacts related to recovered material (recycled and reused) inputs from previous products and the last term covers the impacts related to use of secondary fuels. All terms are calculated per unit of analysis.

Specific emission and resources related to the incineration of waste are included in module C of previous life cycles so they are not included in module A. The formula above represents the environmental impacts caused excluding the incineration of waste (net value). For transparency reasons, the environmental impacts caused by the emissions from processing, incineration and co-incineration of waste (gross value) can also be declared as additional information as follows:

$$e_{module\ A}^{*} = e_{module\ A} + M_{INC\ in} \cdot E_{INC} \quad \text{(D.3)}$$

Formula (D.2) does not explicitly specify emissions and resources consumed related to transport, release of substances in production processes, etc. but they are calculated in the assessment.

The impacts calculated with this equation are related to module A and its submodules.

D.3.3 Module C

The applicable formula for the calculation of the emissions and resources consumed per unit of analysis for module C is the following:

$$e_{module\ C} = M_{MR\ out} \cdot E_{MR\ before\ EoW\ out} + M_{ER\ out} \cdot E_{ER\ before\ EoW\ out} + M_{INC\ out} \cdot E_{INC} + M_{LF} \cdot E_{LF} \qquad (D.4)$$

Where the first term covers the impacts related to waste processing for material recovery (recycled and reused) before end of waste (to be reported in C3), the second term covers the impacts from waste processing for energy recovery, i.e. to become a secondary fuel (the material reaches end of waste before incineration) occurring before end of waste (to be reported in C3), the third term covers the impacts from waste processing and incineration for energy recovery from waste in an installation with efficiency greater than 60 % (to be reported in C3) and the impacts from waste processing and incineration for the thermal treatment of waste in an installation with efficiency lower than 60 % (to be reported in C4) and the last term covers the impacts of landfilling (to be reported in C4).

D.3.4 Module D

In module D the net impacts are calculated according to 6.4.3.3.

The applicable formula for the calculation of the loads and benefits beyond the system boundary per unit of output for module D calculated for each output flow leaving the system boundary is the following:

$$e_{module\ D} = e_{module\ D1} + e_{module\ D2} + e_{module\ D3} + e_{module\ D4} \qquad (D.5)$$

with:

$e_{module\ D1}$ being the loads and benefits related to the export of secondary materials:

$$e_{module\ D1} = \sum_i \left(M_{MR\ out}\big|_i - M_{MR\ in}\big|_i\right) \cdot \left(E_{MR\ after\ EoW\ out}\big|_i - E_{VMSub\ out}\big|_i \cdot \frac{Q_{R\ out}}{Q_{Sub}}\Big|_i\right) \qquad (D.6)$$

$e_{module\ D2}$ being the loads and benefits related to the export of secondary fuels:

$$e_{module\ D2} = \sum_i \left(M_{ER\ out}\big|_i - M_{ER\ in}\big|_i\right) \cdot \left(E_{ER\ after\ EoW\ out}\big|_i - E_{ER\ average}\right) \qquad (D.7)$$

$e_{module\ D3}$ being the loads and benefits related to the export of energy as a result of waste incineration (for $R_1 < 60\ \%$ and $R_1 > 60\ \%$)

$$e_{module\ D3} = -M_{INC\ out} \cdot \left(LHV \cdot X_{INC\ heat} \cdot E_{SE\ heat} + LHV \cdot X_{INC\ elec} \cdot E_{SE\ elec}\right) \qquad (D.8)$$

$e_{module\ D4}$ being the loads and benefits related to the export of energy as a result of landfilling:

$$e_{module\ D4} = -M_{LF} \cdot \left(LHV \cdot X_{LF\ \ heat} \cdot E_{SE\ \ heat} + LHV \cdot X_{LF\ \ elec} \cdot E_{SE\ \ elec}\right) \qquad (D.9)$$

In module D substitution effects are calculated only for the resulting net output flow. 〈A2〉

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Annex E
(informative)

Schemes to be applied for data quality assessment of generic and specific data

Table E.1 — Data quality level and criteria of the UN Environment Global Guidance on LCA database development

Quality level	Geographical representativeness	Technical representativeness	Time representativeness
Very good	Data from area under study	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e. identical technology)	Less than 3 years difference between the reference year according to the documentation, and the time period for which data are representative
Good	Average data from larger area in which the area under study is included	Data from processes and products under study (with similar technology). Evidence of deviations in state of technology, e.g. different by-product.	Less than 6 years of difference between the reference year according to the documentation, and the time period for which data are representative
Fair	Data from area with similar production conditions	Data from processes and products under study but from different technology. This score is also applied when not technology is specified; e.g. wheat (no further specification)	Less than 10 years of difference between the reference year according to the documentation, and the time period for which data are representative
Poor	Data from area with slightly similar production conditions	Data on related processes or products; organic wheat under study, data for organic rye provided.	Less than 15 years of difference between the reference year according to the documentation, and the time period for which data are representative
Very poor	Data from unknown or distinctly different area (North America instead of Middle East, OECD-Europe instead of Russia)	Data on related processes on but with a different scale or from different technology; organic wheat under study, data for conventional wheat provided.	Age of data unknown or more than 15 years of difference between the reference year according to the documentation, and the time period for which data are representative

Table E.2 — Data quality level and criteria from the Product Environmental Footprint Category Rules

Quality level	Geographical representativeness	Technical representativeness	Time representativeness
Very good	The processes included in the data set are fully representative for the geography stated in the "location" indicated in the metadata	Technology aspects have been modelled exactly as described in the title and metadata, without any significant need for improvement	Data are not older than 0 years as expressed in the ILCD field ("data set valid until" and the difference between the "valid until" and the "reference year" is not higher than 8 years)
Good	The processes included in the data set are well representative for the geography stated in the "location" indicated in the metadata	Technology aspects are very similar to what described in the title and metadata with need for limited improvements. For example: use of generic technologies' data instead of modelling all the single plants.	Data are not older than 3 years as expressed in the ILCD field ("data set valid until" and the difference between the "valid until" and the "reference year" is not higher than 8 years)
Fair	The processes included in the data set are sufficiently representative for the geography stated in the "location" indicated in the metadata. E.g. the represented country differs but has a very similar electricity grid mix profile	Technology aspects are similar to what described in the title and metadata but merits improvements. Some of the relevant processes are not modelled with specific data but using proxies.	Data are not older than 6 years as expressed in the ILCD field ("data set valid until" and the difference between the "valid until" and the "reference year" is not higher than 8 years)
Poor	The processes included in the data set are only partly representative for the geography stated in the "location" indicated in the metadata. E.g. the represented country differs and has a substantially different electricity grid mix profile	Technology aspects are different from what described in the title and metadata. Requires major improvements.	Data are not older than 10 years as expressed in the ILCD field ("data set valid until" and the difference between the "valid until" and the "reference year" is not higher than 8 years, confirmed by the reviewer(s))
Very poor	The processes included in the data set are not representative for the geography stated in the "location" indicated in the metadata.	Technology aspects are completely different from what described in the title and metadata. Substantial improvement is necessary.	Data are older than 10 years as expressed in the ILCD field ("data set valid until" and the difference between the "valid until" and the "reference year" is not higher than 8 years)

〈A2〉

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