Product Category Rules for Building-Related Products and Services in:

Brazil	Japan
China	Korea
Europe	North America
India	South East Asia

Part A: Life Cycle Assessment Calculation Rules and Report Requirements

UL Environment
Standard 10010
Version 3.2
www.ul.com/businesses/environment

UL Verification Services, Inc.
333 Pfingsten Road
Northbrook, Illinois 60062

Version tracking

Version	Comments	Date
1.0	Implemented EN 15804 in the IBU range regulations. This document replaces the previous “General Principles” (valid as at 20.01.2006).	27.09.2011
1.1	Adapting the standard quotations in accordance with the latest version of EN 15804.	20.09.2012
1.2	Additional texts and decisions by the SVA (from 22.03.2013) implemented.	03.04.2013
1.3	Revision to harmonize and regionalize to North American applicability under mutual recognition program with UL Environment	19.06.2014
2.0	Update to incorporate more stringent project report and EPD reporting requirements in collaboration with USGBC with input from a Technical Advisory Panel	16.3.2017
3.0	Updated to conform with ISO 21930:2017 and expanded scope to include Brazil, China, India, Japan, Korea, and South East Asian markets	06.11.2017
3.1	Updated to reference Sections of ISO 21930 and incorporate content previously in sub-category Part B PCRs	05.02.2018
3.2	Updated to reconcile differences in ISO 21930:2017 and EN 15804 via panel review	08.XX.2018

Acknowledgements

Technical Advisory Panel members reviewed and provided feedback on content written by UL Environment and US Green Building Council (USGBC). Past and present members of the Technical Advisory Panel include the following individuals:

CURRENT MEMBERS

Paul Firth, UL Environment
Tom Gloria, Industrial Ecology Consultants
David Green, BASF
Christoph Koffler, thinkstep
Keith Lindemulder, Nucor
Lise Laurin, Earthshift Global
David Marcus, USGBC
Anna Lasso, UL Environment
Brenden Owens, USGBC
Eva Schmincke, thinkstep
Kate Simonen, University of Washington

PAST MEMBERS

Sarah Buffaloe, USGBC
Sara Cederberg, USGBC
Wes Ingwersen, EPA
Wayne Trusty, Independent Consultant

Per the ISO 14025 requirements, this Part A was reviewed by the following critical review panel:

Lindita Bushi, PhD, Chair
Athena Sustainable Materials Institute
lindita.bushi@athenasmi.org

Hugues Imbeault-Tétreault, ing., M.Sc.A.
Groupe Ageco
hugues.i-tetreault@groupeageco.ca

Jack Geibig
Ecoform
jgeibig@ecoform.com

Product Category Rules for Building Related Products and Services, UL 10010

Fifth Edition

Dated September 18, 2018

Summary of Topics

The fourth edition of the Part A: Product Category Rules for Building Related Products and Services, UL 10010 Version 3.2 has been issued.

Subject to these terms and conditions and those in any other agreements between you and UL Environment, Underwriters Laboratories Inc. (UL) and/or their representatives, you are hereby granted a limited, non-exclusive, non-transferable license to use the Product Category Rules (PCR) solely for your internal, non-commercial business purposes. The PCR is not being sold, and other than the limited license granted herein UL retains all rights, title and interest (including exclusive ownership) in the PCR and all copyright therein. UL reserves the right to regain possession of the PCR from you at any time. When no longer needed, you agree to destroy the PCR (if in hardcopy form) or delete and purge the PCR from your files (if in electronic form). No part of the PCR may be reproduced, modified, stored in a retrieval system, or transmitted in any form by any means, whether electronic, mechanical photocopying, recording, or otherwise without prior written permission of UL or UL Environment. You further agree not to create any derivative works from the PCR or remove or alter any copyright or other proprietary notices in the PCR. The limited license to use the standard shall automatically terminate upon your breach of any of the terms and conditions herein or any other agreement between you and UL, UL Environment and/or their representatives.

UL Environment provides this PCR “as is” without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL Environment, UL or any of their affiliates be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this PCR, even if UL Environment or UL or their authorized representative has been advised of the possibility of such damage. In no event shall UL Environment's or UL's liability for any damage ever exceed the price paid for the license to use this PCR, regardless of the form of the claim.

Users of the electronic versions of UL Environment's Product Category Rules agree to defend, indemnify, and hold UL Environment, ULI, their affiliates and each of their respective trustees, officers, employees, agents and representatives harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic PCR on the purchaser's computer system.

TABLE OF CONTENTS

1 Background 5

2 LCA Project Report Content, Structure, and Accessibility 6

2.1 General Information 6

2.2 Study Goal 7

2.3 Methodological Framework 7

2.4 Declared/Functional Unit 7

2.5 Product Averages for EPDs 7

2.5.1 Industry Average EPD 8

2.5.2 Manufacturer Specific EPD 8

2.6 Product Description 8

2.7 Product Application 9

2.8 System Boundaries 9

2.8.1 Types of EPDs 10

2.8.2 Reference Service Life and Building Estimated Service Life 10

2.8.3 System Boundary with Nature and Between Product Systems 11

2.8.4 System Boundaries and Scenarios 11

2.8.5 Disposal Pathways by Region 17

2.8.6 Waste Classification by Region 19

2.8.7 Incineration Efficiency 20

2.8.8 Power Mix 21

2.8.9 CO_2 Certificates 21

2.9 Cut-Off Rules 22

3 Life Cycle Inventory Analysis 22

3.1 Data Selection, Collection, and Data Quality 22

3.1.1 Data Quality Evaluation 24

3.1.2 Background Data 24

3.2 Calculation Procedures 25

3.3 Allocation 25

3.3.1 Allocation Between Product Systems (Across the System Boundary) 26

3.3.2 Description of Allocation Processes in the Project Report 28

3.4 Description of the Unit Processes in the Project Report 28

4 Life Cycle Inventory and Impact Assessment Results 29

4.1 Life Cycle Inventory Indicators per ISO 21930 and EN 15804 29

4.1.1 Freshwater Consumption 30

4.1.2 Waste Categories and Output Flows 30

4.2 Accounting for Biogenic Carbon Uptake and Emissions 31

4.3 Accounting for Calcination and Carbonation 31

4.4 Accounting of Delayed Emissions 32

4.5 Greenhouse Gas Emissions from Land-Use Change 32
4.6 Carbon Emissions and Uptake 32
4.7 Life Cycle Impact Assessment Indicators for North America 32
4.8 Life Cycle Impact Assessment Indicators For Europe 33
4.9 International Life Cycle Impact Assessment Indicators 34
4.10 Optional LCIA Indicators and Other Additional Environmental Information 35
4.11 Mandatory Environmental Information 35
4.11.1 Regulated Hazardous Substances 35
4.11.2 Dangerous Substances 36
4.12 Units 36
5 Life Cycle Interpretation 36
6 Documentation of Additional Information 37
6.1 Laboratory Results and Scenario-Related Information 37
6.2 Documentation for Calculating the Reference Service Life (RSL) 37
6.3 Data Available for Verification 37
7 EPD Reporting Requirements 38
7.1 Declaration of General Information 38
7.2 Declaration of Methodological Framework 40
7.3 Declaration of Technical Information and Scenarios 40
7.4 Declaration of Environmental Parameters Derived From LCA 40
7.5 Declaration of Additional Environmental Information 40
7.6 References 41
8 Further EPD Requirements 41
8.1 EPD Ownership, Liability and Responsibility 41
8.2 Content of EPD 41
8.3 Verification 41
8.4 Validity 41
8.5 Comparability 41
9 Comparability and Benchmarking of EPDs 42
9.1 Benchmarking in EPDs 42
9.2 Industry-Average Benchmarking 42
9.3 Manufacturer-Specific Benchmarking 44
10 References 45
11 Modifications for North American Harmonization and Regionalization 45

1 BACKGROUND

This document is a core PCR standard for construction works-related products and services and is meant to be used with product- and service-specific, sub-category Part B PCR documents by any Program Operator. Part B PCR documents that reference this Part A may be developed by any Environmental Product Declaration (EPD) Program Operator.

This document specifies the calculation rules and reporting requirements for the underlying Life Cycle Assessment (LCA) reports used to inform EPDs in accordance with ISO 21930 and EN 15804. An LCA project report must be submitted for each EPD registered.

This document cites the ISO 21930 and EN 15804 standards in many Sections. Certain clauses of these standards' text have been omitted for reasons of readability, however not with the intention to compromise the conformity of this document with ISO 21930 and EN 15804. Those clauses are marked as [...].

There are several compatibility issues with ISO 21930 and EN 15804 which are specifically noted in this Part A (See Section 2.8.4.1.2). Whenever compatibility issues arise, whether addressed in this Part A or not, the requirements in ISO 21930 shall take precedence over EN 15804. If it is necessary for an EPD to explicitly conform to EN 15804 and not ISO 21930, this precedence will not apply.

Whenever 'justification' is required in this text, it is intended to be included in the LCA report, unless otherwise stated.

2 LCA Project Report Content, Structure, and Accessibility

The LCA project report represents the systematic and comprehensive summary of project documentation that supports the verification of an EPD. The project report must document any data and information of importance to the results published in the EPD and as required by this document.

The project report must support that the LCA-based information and the additional information as declared in the EPD meet the requirements of this set of rules. Particular care shall be given to provide comprehensive explanations regarding how the information declared in the EPD arises from the LCA and how – if declared – the reference service life (RSL) was established.

The structure of the project report shall follow the structure of this standard based on ISO 21930 and EN 15804. See ISO 21930 Section 10 for detailed requirements of the project report.

The project report must be accessible to the verifier under the conditions of confidentiality (see ISO 14025 and ISO 21930).

In conformance with ISO 21930, Section 10.2, the results, data, methods, assumptions, limitations and conclusions of the project report shall be completely and accurately reported without bias. All elements of the project report shall be reported in a transparent manner with enough detail to allow independent verification and 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 is not part of the public communication.

2.1 General Information

The project report must contain the following general information:

- The client commissioning the Life Cycle Assessment, internal or external Life Cycle analysts
- The report date

- Indications that the Life Cycle Assessment was performed in agreement with the requirements of these Product Category Rules with reference to ISO 21930 and EN 15804.

Any Part B PCR which is based on this Part A standard must include all unchanged elements of this Part A PCR according to ISO 21930 Section 6.1. In the case that any requirements in the specified elements conflict between Part A and Part B, Part A shall be followed.

Sub-category Part B PCRs based on this Part A standard must either include: a) the same structure and text as ISO 21930 along with additional elements and specifications for the product sub-category, or b) only the headings from and references to ISO 21930 with additional elements and specifications for the product sub-category.

The UNSPSC code and the appropriate Construction Specifications Institute (CSI) / Constructions Specifications Canadian (CSC) classification shall be identified for the product category covered by the Part B PCR.

2.2 Study Goal

The study goal must be outlined in the project report, including the following:

- Reasons for performing the study
- Intended use
- Target group, i.e. whether the information and data for an EPD is intended for business -to-business (B2B) and/or business-to-consumer (B2C) communication.

[ISO 21930, Section 5.4]: “The environmental information on construction products is intended mainly for B2B communication and its prime purpose is to provide measurable and verifiable input for the assessment and improvements of the environmental performance of construction works. However, some EPDs may be used in the B2C marketplace and, when doing so, the user of this document shall follow the provisions of ISO 14025:2006, Clause 9.”

2.3 Methodological Framework

The LCA shall follow an attributional approach as outlined in ISO 21930 Section 7.1.1.

2.4 Declared/Functional Unit

The Life Cycle Assessment of the construction product must be calculated for a declared or functional unit as specified in the relevant sub-category Part B PCR for the product group, in conformance with ISO 21930 Section 7.1.2 and 7.1.3 and EN 15804.

The selected declared or functional unit must be documented in the project report. In addition, a mass conversion factor of the declared unit shall be indicated, where appropriate.

2.5 Product Averages for EPDs

Averaging of products may significantly reduce EPD development efforts by allowing manufacturers to use one LCA for multiple products and should be considered during the PCR development. Two types of product averages are allowed using this PCR; industry average EPDs and manufacturer-specific averages.

The range of products included in an EPD shall be justified in the context of EPD application; i.e. what the EPD represents. It is crucial that the reasoning be explained and the average reported value can be understood. For example, if a single product is made using a single process, but contains variance of recycled content (different for different locations), an EPD can represent the product as an average of the virgin and recycled material content given the rationale is fully explained. An average is also appropriate in the case of products demonstrating a wide range of variation based on selection of materials serving the same function, such as choice of upholstery fabric on a seat chair cushion.

Further guidance and clarification for calculating and reporting product averages may be provided by the relevant Part B PCR and shall be followed.

2.5.1 INDUSTRY AVERAGE EPD

The method for creating an industry-average EPD shall be described. To ensure an industry-average EPD is representative, the information provided in the average EPD and in the LCA report shall be presented according to ISO 21930 Section 5.3.

Note: Include how a sufficient statistical representation is achieved, how geographic location is assessed, and how the average is weighted to insure sufficient representation so as to avoid bias. A quantitative assessment of primary dataset variability, including mean, median, standard deviation, and best fitting probability distribution function shall be included.

The method of dataset averaging shall be described (i.e., horizontal or vertical averaging) and justified. The justification shall consider if data is more appropriately represented by standalone gate-to-gate processes (horizontal averaging) versus capturing the flow of goods within a facility(ies) (vertical averaging).

A qualitative assessment shall be provided within the EPD that estimates percent representation of industry and percent geographical region representation, the median reference flow units (e.g. weight, area, volume), and other contributing sources of variation (e.g. operational capacity, grid mix). Per ISO 21930 Section 5.3, a sensitivity analysis should be conducted on the differences between the products included the average.

2.5.2 MANUFACTURER SPECIFIC EPD

The method for creating a company specific individual product/product group EPD shall be described, including the method for determining a weighted average across products based on production volume. If a product is manufactured at different production sites, the sites shall be indicated and method for determining the weighted average shall also be described.

Note: Products of similar specifications, and utilized for the same application(s) may be grouped and reported as an average declared product in the same EPD provided that 1) the products included in the grouping differ by no more than ±10 % for any environmental impact indicator and 2) the weighted coefficient of variation across all products shall be less than or equal to 20% for any impact category with the exception of Ozone Depletion Potential (ODP). If the weighted coefficient of variation is 20% or greater for any impact category with the exception of ODP, each product shall be shown separately. Quantitative justification should be provided in the LCA that substantiates the reported average declared product.

2.6 PRODUCT DESCRIPTION

The declared product must be described with regards to its technical and functional specifications.

[ISO 21930, Section 6.3]: “The product group covered by a sub-category Part B PCR shall be described unambiguously.

The definition may consider product functionality (e.g. conveyance of materials through pipes), typical production processes (e.g. mining or oil refinery) or applications (e.g. for use in cold climates).

If there is potential ambiguity in the product sub-category, the description shall also state which products are not covered by the sub-category Part B PCR."

2.7 PRODUCT APPLICATION

The designated application(s) for the referenced product(s) shall be specified/described.

2.8 SYSTEM BOUNDARIES

The system boundaries of the LCA and EPD shall follow the modular structure in line with ISO 21930 Section 5.2.1 and EN 15804 Section 6.2. This PCR encourages, when possible, EPDs that are cradle to grave in scope (Modules A1-C4) but also recognizes EPDs that are cradle to gate (Modules A1-A3) and cradle to gate with optional modules as being in scope.

The environmental information of an EPD shall be subdivided into four life cycle stages per Figure 1: Production (Modules A1-A3); Construction (Modules A4-A5); Use (Modules B1-B7); and EOL (Modules C1-C4). Only the declaration of the Production modules, A1-A3, is required for conformance with ISO 21930 or EN 15804. The declaration of other life cycle modules is optional, unless specifically addressed in a sub-category Part B, with the exception of Module C (see Section 2.8.4.5). Module D is not a life cycle stage like the life cycle stages assessed in information modules A1 to C4. Module D is outside the system boundary of the studied product system and construction works system.

Any omissions of life cycle stages, processes or data shall be documented and justified in the LCA and EPD.

Figure 1. Common four life cycle stages and their information modules for construction products and construction works and the optional supplementary module D (adapted from Figure 2, ISO 21930)

	PRODUCTION			CONSTRUCTION		USE							END OF LIFE				BENEFITS & LOADS BEYOND SYSTEM BOUNDARY	
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
EPD Type	Raw material supply	Transport	Manufacturing	Transport to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential	Reference Service Life
Cradle to gate	*Required*			*Excluded*									*Required, depending on Section 2.8.4.5*				*Optional*	Optional
Cradle to gate with options	*Required*			*Optional*		*Ex.*	*Op.*	*Excluded*					*Optional*				*Optional*	Optional
Cradle to grave	*Required*																*Optional*	Required

* Modules B2 – B5 include production, transport and disposal of necessary materials
** Module B4 is not applicable at the product level

For construction products requiring activity or use of energy and/or water during the use stage, technical information for the relevant information modules (B2 to B5 or B6 and/or B7, respectively) is required per ISO 21930, Section 5.2.1.

When a product EPD only includes Module A (Production stage), the following information regarding intended use of the product shall be provided as additional information:

- Other products not included in assessment needed for product to serve intended function in the construction work
- Anticipated replacement cycle of product in the construction work context
- Intended use

Supplementary environmental information may also be provided in module D that addresses potential loads and benefits beyond the product system boundary.

2.8.1 TYPES OF EPDS

Per ISO 21930, Section 5.2.2 “The LCA-based information in an EPD may cover different combinations of information modules, i.e. cover different life cycle stages or parts thereof. There are three types of EPDs: “cradle to gate”, “cradle to gate with options” and “cradle to grave”. See Figure 1 for the information modules included in each type of EPD.

The sub-category Part B PCR shall state the type of EPDs allowed according to the definitions provided in ISO 21930, Section 5.2.2, and shall also include the required scenarios according to ISO 21930, Section 7.1.7.

It may also contain only the relevant technical information for further calculation of the environmental performance in the scenarios.

2.8.2 REFERENCE SERVICE LIFE AND BUILDING ESTIMATED SERVICE LIFE

The indication of the RSL is required for EPDs covering the complete use stage (modules B1-B7), or if a use stage scenario is described, which refers to the lifetime of the product. If no use stage modules are declared, and no use stage scenario which refers to the lifetime of the product is described, the indication of the RSL is voluntary. Refer to ISO 21930 Section 7.1.4 for more information.

The RSL information to be declared in an EPD covering the use stage shall be provided by the manufacturer. If primary data to support declaration are unavailable, a default RSL of 75 years may be assumed for the product category system (if applicable; described as part of the functional unit or reported under additional environmental information, if all life cycle stages are not declared) unless the sub-category Part B PCR indicates otherwise, or if otherwise stated and substantiated. When reporting the number of replacements necessary to fulfil the required performance and functionality over the construction works Estimated Service Life (ESL), fractional values shall be rounded up to the nearest tenth. An assumed ESL of 75 years shall be used for the construction works life.

The RSL shall refer to the declared technical and functional performance of the product. A standard life expectancy based on the prescribed method or default of 75 years shall be used, with the option of any deviation allowed only if justified in writing, publicly available for review, and posted for publication. When reported, the RSL shall be established in line with all of the specific rules in North American (NA) product standards and shall also consider, but not necessarily adhere to, the ISO 15686-1, -2, -7 and -8 standards. Where information is available for deriving the RSL from NA product standards, such data has priority. This PCR acknowledges product manufacturers cannot be held responsible for the actual design of the construction works, use and application of the product, environment, or workmanship.

The assumptions upon which the designated RSL is based and for which the RSL exclusively applies shall be provided in project report. Influences on ageing, when applied, shall be in accordance with the state of the art.

2.8.3 System Boundary with Nature and Between Product Systems

System boundaries with nature and between product systems shall be defined, calculated and reported according to ISO 21930 Sections 7.1.5 and 7.1.6.

2.8.4 System Boundaries and Scenarios

[ISO 21930, Section 7.1.7.1]: “The information modules A1, A2 and A3 are based on the actual and representative data of the production process of the product. However, as soon as a construction product leaves the factory gate, the assessment shall be based on scenarios and assumptions. The scenarios and assumptions considered depend upon various details including location, type of transport, method of installation and construction, type of construction works, use, maintenance and repair, end-of-life treatment and waste handling.”

Specific requirements for scenarios and assumptions shall follow ISO 21930 Section 7.1.7.1, and additional requirements may be provided in the sub-category Part B PCR.

[ISO 21930, Section 7.1.7.1]: “Within an EPD, the indicators declared in the individual information modules of a product life cycle (i.e. A1 to A5, B1 to B7, C1 to C4) and the optional supplementary information beyond the life cycle (module D) shall not be aggregated in any combination of the individual information modules into a total or subtotal of the life cycle stages. As an exception, individual indicators for information modules A1, A2 and A3 may be aggregated to a total for each indicator in the production stage.”

[EN 15804, Section 6.3.8]: “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 the required modules A1 to A3; scenarios shall support the assessment of the environmental performance of a building in its life cycle stages “construction, use stage, end-of-life” [...].

Scenarios shall be provided only for the environmental assessment. A scenario shall be based on relevant technical information. With the help of the scenario, the predetermined parameters of the EPD are derived by applying the calculation rules given in this standard.

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.

For EPDs that declare optional information modules, the additional technical information related to the scenarios underlying these modules is required.”

If an optional module declares the life cycle, the relevant technical information, e.g. recycling or reuse rates, must be documented in the project report with reference to the respective literary source.

2.8.4.1 A1-A3, Production stage, information modules

[ISO 21930 Section 7.1.7.2, supplemented with EN 15804 Section 6.2.2]: “The product stage includes:

A1 Extraction and upstream production;
A2 Transport to the factory;
A3 Manufacturing.

Information modules A1 to A3 shall be included in every EPD. The system boundary with nature shall include those technical processes that provide the material and energy inputs into the system and the subsequent manufacturing and transport processes up to the factory gate, as well as the processing of any waste arising from those processes. All materials, products and energy, as well as processing up to the system boundary between product systems[1] or disposal of final residues during the product stage shall be provided. For a detailed description of what shall be included in modules A1-A3, refer to ISO 21930 Sections 7.1.7.2.2 – 7.1.7.2.4.

[ISO 21930 Section 7.1.7.1 and EN 15804 Section 6.2.2]: “Modules A1, A2 and A3 may be declared as an aggregated Module A1-3.”

The flows crossing into the system at the A1-A3 boundary are determined as follows:

- Production waste that is *recycled* without any modification of the material inherent characteristics (i.e. closed-loop or open-loop considered closed loop) can be considered as recycled within Modules A1-A3. This is only possible up to the volume that was used as input in production.
- Heat and power from energy recovery of production waste in Modules A1-A3 can be considered closed-loop within Module A1-A3 if they are used at the same quality within Modules A1-A3 and only to the maximum amount in MJ as is required of the respective energy quality in MJ during production (assumption: overall manufacturing, A1-A3, considered as a module)..

If an allocation procedure different from co-product allocation is chosen for flows that reach the system at the boundary A1-A3, or datasets are chosen where allocation procedures are unknown, this procedure has to be justified or clarified as a dataset limitation. Ideally, datasets should be used that clarify allocation procedures. The resulting material and energy flows are to be described transparently in the project report with regard to the amounts of materials and energy within Module A1-A3.

2.8.4.1.1 Coproducts leaving system

[ISO 21930 Section 7.1.7.2.6, supplemented with EN 15804 Section 6.3.4.2]: “Co-products from unit processes leaving the system at the production stage (A1-A3) shall be allocated in accordance with ISO 21930 Section 7.2.5. Loads and benefits from allocated co-products shall not be declared in Module D.” (See Section 2.8.4.6 of this standard.)

2.8.4.1.2 Output of waste

ISO 21930 and EN 15804 have different approaches on the treatment of waste, as provided below. For the purposes of this standard, the approach detailed in ISO 21930 shall be used unless an EPD requires explicit conformance with EN 15804.

[1] It should be noted that terminology “end-of-waste state” is instead used in EN15804 (EN 15804 Section 6.2.2, Clause 6.3.4.5 and Annex B); ISO 21930:2017 eliminated this terminology and uses the term “processing up to the system boundary between product systems.”

ISO 21930 Section 7.1.7.2.7: “The output of waste during [the Production] life cycle stage may become a useable output flow, such as a secondary material/fuel or recovered energy, when it has been through a recovery process and complies with the conditions described in the system boundary between product systems (see ISO 21930 Section 7.1.6). These useable output flows shall not be considered as co-products but shall be considered waste and no allocation to secondary material, secondary fuels or recovered energy shall be permitted.”

While loads and benefits from allocated co-products shall not be declared in Module D, waste recovered as a useable output flows may be considered from recovery processes and included as supplementary information in module D.

EN 15804 Section 6.4.3.2: “Flows leaving the system at the end-of-waste[2] boundary of the production stage (A1 -A3) shall be allocated as co-products.

The output of waste during this life cycle stage may reach the end-of-waste state[3] when it complies with the conditions described in EN 15804 Section 6.3.4.5, end-of-life stage. They are then allocated as co-products as EN 15804 Section 6.4.3.2.”

2.8.4.2 A4-A5, Construction stage, Information modules

[ISO 21930 Section 7.1.7.3.1, supplemented with EN 15804 Section 6.2.3]: “The construction process stage includes the following two information modules A4 to A5:

A4 Transport to site;
A5 Installation;

Information modules A4 to A5 include provision of all materials, products and energy, as well as waste processing up to the system boundary between product systems or disposal of final residues during the construction stage. They also include all aspects and impacts related to any losses during this construction process stage (i.e. production, transport and waste processing and disposal of the lost products and materials).”

When a product is sold as a system, e.g. as a package including the installation materials, then the entire *production* of all components and product residues that might occur in A5 are to be declared in A1-A3. The transport of the system to the site is to be declared in A4. The installation inclusive waste treatment is to be declared in A5.

[ISO 21930 Sections 7.1.7.3.2 – 7.1.7.3.3, supplemented with EN 15804 Section 6.3.4.3]: “The construction stage includes the optional information modules for:

A4 Transportation from the factory gate to central warehouse or intermediate storage site, if relevant
A4 Transportation to the construction site
A4-A5 Storage of products, including heating, cooling, humidity control, etc.
A5 Construction product waste (additional production and transport processes to compensate for the loss of product waste)
A5 Waste processing of product packaging waste and product waste during the construction process up to the system boundary between product systems or disposal of final residues

[2] See footnote 1

[3] See footnote 1

A5 Product installation into the construction works, including the manufacturing and transport of ancillary materials, direct energy use, and freshwater consumption required for installation

A5 Site preparation required for product installation, including ancillary materials and waste management

Transport distances should be as specific as possible. The distance to the construction site may be estimated based on weighted average distance to the market of the product.

If no specific information for the efficiency of waste incineration plants (R1 value; see Section 2.8.7) of the incineration plant is available, it is assumed that packaging materials (and potential product waste from the installation process) are treated thermally in a plant with R1<0.6. Thus, the combustion process (loads) for the packaging is to be declared in Module A5, the resulting benefits in Module D.

The information in from ISO 21930 Section 7.1.7.3.4 shall be included, as below: “The information in [the following table] shall be provided for all construction products to specify the end-of-life scenarios used for packaging or to support development of the end-of-life scenarios for packaging at the construction works level where the module is not declared. Scenarios shall only model processes, for example recycling systems that have been proven to be economically and technically viable.

Table 1. A5 Product Packaging Waste (adapted from ISO 21930 Section 7.1.7.3.4, Table 2)

Module	Parameter	Unit (expressed per functional unit or per declared unit)	Value
A5 Installation of the product	Mass of packaging waste Specify by type	kg or other unit as appropriate	
A5 Installation of the product	GWP based in biogenic carbon content of packaging, specify by type, (where relevant)	kg CO_2e	

2.8.4.3 B1-B5, Use stage information modules

[ISO 21930 Section 7.1.7.4.1] “The use stage of the construction works includes information modules covering the period from the handover to when it is deconstructed or demolished. The product level use stage may be vastly different when considered in the context of the construction works since the products will have varying RSLs, encounter differing exposure conditions (with corresponding ESLs) and might be replaced, repaired, and maintained several times over the span of the required service life of a construction works.”

“Any deviation from the categorization of aspects and impacts into modules B1 to B5 and B6 to B7 shall be reported in a transparent manner and justified.”

[ISO 21930 Section 7.1.7.4.2 and similarly EN 15804 Section 6.2.4]: “The use stage of the construction works includes the following five information modules:

B1 Use or application of the installed product

B2 Maintenance (preventative and regular maintenance activities required for product function and technical performance, e.g. cleaning);

B3 Repair (corrective, responsive, or reactive treatment of a product or its parts (e.g. a broken component), including preservation of aesthetic qualities);

B4 Replacement (required when an entire product needs to be replaced, instead of a repairing a broken part or component);

B5 Refurbishment (required to return a product to its functional condition during its service life, i.e. restoration).

This includes provision and transportation of all materials, products and related energy and water use, as well as waste processing up to system boundary between product systems or disposal of final residues during this part of the use stage. These information modules also include all aspects and impacts related to the losses during this part of the use stage (i.e. production, transport, waste processing and disposal of the lost products and materials)."

The B1 - B5 use stage information modules shall be covered according to ISO 21930 Section 7.1.7.4.2 and EN 15804 Section 6.3.4.4. Additional required assumptions for these information modules may be included in a sub-category Part B PCR.

2.8.4.4 B6-B7, Use stage information modules relating to operation of the construction works

[ISO 21930 Section 7.1.7.4.3.1 and similarly EN 15804 Section 6.2.5]: "The use stage relating to the operation of the construction products includes the following two information modules:

B6 Operational energy use (e.g. operation of a heating system and other technical construction works-related installed services);

B7 Operational water use;

Information modules include provision and transport of all materials, products, as well as energy and water provisions, waste processing up to the system boundary between product systems or disposal of final residues during this part of the use stage."

B6 - B7 use stage information modules shall be covered according to ISO 21930 Sections 7.1.7.4.3.2 - 7.1.7.4.3.3 and EN 15804 Section 6.3.4.4.3.

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

The declaration of Module C is required in an EPD unless either of the following conditions are met[4]:

1. Life cycle data for end-of-life is included and broken out separately in the LCA project report, in addition to one of the following:

- Recycling is directly controlled or supported by manufacturer, OR
- Landfill generic data per the product category is used, and has been standardized for comparability.

OR

2. A qualitative statement is provided in the LCA and EPD describing the typical end-of-life treatment of the product, including:

- Typical end-of-life scenarios are outlined

[4] This is a USGBC PCR guidance document requirement, in addition to the requirements listed in ISO 21930 Section 5.2.1 and EN 15804 Section 6.2.

- Recycling is reported as average or product specific recycling rates and standard reporting procedures are outlined, such as manufacturer take-back programs
- Biogenic carbon content/potential for decay is addressed

The end-of-life information modules are as follows, and should be covered per ISO 21930 Section 7.1.7.5 and EN 15804 Section 6.2.6:

C1 Deconstruction/Demolition (includes dismantling or demolition of the product from the site and the required energy to do this, including on-site material sorting)

C2 Transportation to waste processing or disposal

C3 Waste processing (includes collection of waste from deconstruction, recovery, and waste processing of material flows resulting in materials for reuse, secondary materials, secondary fuels, or export of energy recovered from waste with an efficiency of at least 60%, regardless of existing legislation)

C4 Disposal of waste

It is important to note that if there are, for example, three different recovery and disposal options for a product system, the most commonly used one, or all three scenarios, shall be declared separately. Also, per ISO 21930 Section 7.1.7.5, "A scenario based on a typical end-of-life, for example a mix of recovery and disposal options based on a national situation, shall only be provided if the scenarios for the separate individual options are also provided."

A sub-category Part B PCR may provide additional requirements regarding product disposal pathway assumptions beyond what is provided in Section 2.8.5.

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 system boundary between product systems or disposal of final residues.

2.8.4.6 Benefits and loads beyond the product system boundary, information Module D

[ISO 21930 Section 7.1.7.6] "Module D is not a life cycle stage like the life cycle stages assessed in information modules A1 to C4. Module D is outside the system boundary of the studied product system and construction works system. Module D is not an allocation approach and does not report impacts that are allocated to other product systems as a result of co-production or recovery processes. Module D provides optional supplementary information about the potential net benefits from reuse, recycling and energy recovery beyond the system boundary of the studied product system."

Unless specified otherwise in a sub-category Part B PCR, Module D may be included in an LCA and EPD, and the results shall conform with ISO 21930 Section 7.1.7.6 and EN 15804 Section 6.3.4.6 as well as the requirements below. Specifically, per ISO 21930 Section 7.1.7.6, "the net output flow for all products for reuse, secondary materials, secondary fuels and/or recovered energy leaving a product system is calculated by adding all output flows of the secondary material or fuel or recovered energy and subtracting any input flows of this secondary material or fuel or recovered energy from each information module (e.g. A1 to A5, B1 to B5, C1 to C4) thus arriving at the net output flow of secondary material or fuel or recovered energy from the product system."

When reporting Module D results, the potential environmental loads and benefits shall be reported separately. When reporting Module D, the following non-emission specific quantitative and qualitative data shall also be included, but is not limited to:

- Recycled content
- Percent recyclability
- Reuse and recovery opportunities
- Mass of recyclable materials

2.8.5 DISPOSAL PATHWAYS BY REGION

The following disposal pathways for the product shall be used by region or country unless justified otherwise or specified differently in the sub-category Part B PCR. Results for each of the individual options shall also be separately reported, as required by ISO 21930 Section 7.1.7.5 (i.e., if results are presented of a scenario that includes landfill, recycling, and incineration, then results must also be presented separately for 100% landfill, 100% recycling, and 100% incineration).

Table 2. Product Disposal Assumptions by Region

Country/Region	Material	Recycling Rate	Landfill Rate	Incineration Rate
Brazil[5]	All	0%	100%	0%
Canada	All metals[6]	85%	15%	0%
	Other materials	7%[7]	93%	0%
China[8]	All	5%	95%	0%
EU	All	50%[9]	37%[10]	13%[11]
India[12]	All	0%	100%	0%
Japan[13]	All	53%	4%	43%
Korea[14]	All	83.9%	9.4%	6.1%
United States[15]	All metals	85%	15%	0%
	Other materials	0%	100%	0%

[5] Favaretto et al. Characterization and Use of Construction and Demolition Waste from South of Brazil in the Production of Foamed Concrete Blocks. Applied Sciences. September 2017.

[6] Canada and the US have similar recycling rates for all metals. See Footnote 14. In average, "all metals" comprise around 7% of the C&D total waste [8.1% -construction; 5.1% demolition]. Available at https://link.springer.com/article/10.1007/s10098-012-0481-6 (Accessed on 16 August 2018)

[7] It is estimated that the construction industry in Canada generates about 9 million tons of C&D waste annually. This amount accounts for one-third of solid waste stream of the country. Available at: https://link.springer.com/article/10.1007/s10098-012-0481-6 (Accessed on 16 August 2018). Approximately 600,000 tons are diverted each year. Available at https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810003401 (Accessed on 16 August 2018). Calculated recycling rate= 600,000/9,000,000 = 7%.

[8] Huang et al. Construction and demolition waste management in China through 3R principle. Resources, Conservation and Recycling. February 2018.

[9] European Commission. EU Construction & Demolition Waste Management Protocol. 2016. Available online: http://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en (Accessed on 16 August2018)

[10] Calculated from recycling and incineration rates

[11] Taken as average of incinerated packaging waste in Table 3.

[12] Thomas, J. and Wilson, P.M. Construction waste management in India. American Journal of Engineering Research. 2013.

[13] Ministry of the Environment, Waste Management and Recycling Department. History and Current State of Waste Management in Japan. 2014. https://www.env.go.jp/en/recycle/smcs/attach/hcswm.pdf (Accessed on 16 August 2018)

[14] Waste Resources Management and Utilization Policies of Korea. 2016. http://www.ksp.go.kr/common/attdown.jsp?fidx=694&pag=0000700003&pid=210. Numbers do not add to 100%; 0.4% of waste is sent to sea. (Accessed on 16 August, 2018)

[15] This PCR assumes the same recycling rate for all metals, in particular steel and aluminum. Structural steel is estimated to be recycled at 98% and reinforcing steel at 71%. While neither rate directly applies to the all products covered by this PCR, they provide an indication that steel construction products, like all steel products, have demonstrated high recycling rates. Steel products that are easy to access during demolition are likely recycled at a rate closer to structural steel than rebar, which is often enclosed in concrete and more difficult to recover. This PCR assumes an average steel recycling rate of 85% (average of 98% and 71%), which also aligns with a recycling rate of 85% for aluminum. http://www.aluminum.org/product-markets/building-construction, January 2018. (Accessed on 16 August, 2018)
http://www.steel.org/~/media/Files/AISI/Reports/2017-AISI-Profile-Book.pdf, 2017. (Accessed on 16 August, 2018)

South East Asia - Malaysia[16]	Concrete and aggregate	68%	32%	0%
	Wood	4%	96%	0%
	Others	0%	100%	0%
South East Asia – Singapore[9]	All	94%	6%	0%
South East Asia – Other[17]	All	5%	95%	0%

The following disposal pathways shall be used for the product packaging unless justified otherwise or specified differently in the sub-category Part B PCR.

Table 3. Packaging Disposal Assumptions by Region

Country/Region	Material Type	Recycling Rate	Landfill Rate	Incineration Rate
Brazil[18]	Plastic	13.5%	86.5%	0%
	Metals	70%[19]	30%	0%
	Glass	2.4%	97.6%	0%
	Pulp (cardboard, paper)	13.1%	86.9%	0%
	Wood	51.4%	48.6%	0%
Canada	Plastics	78%[20]	22%	0%
	Other materials	20%[21]	80%	0%
China	Plastics	25%[22]	56%	19%[23]
	Metals	20%[24]	80%	0%
EU[25]	Plastic	40.3%	28.7%	31.0%
	Metals	76.2%	23.3%	0.5%
	Glass	73.2%	26.7%	0.1%
	Pulp (cardboard, paper)	82.8%	9.4%	7.8%
	Wood	39.8%	34.5%	25.7%
India	All	10%	90%[26]	0%
Japan	Metals	98%[27]	2%	0%

[16] Borongan, G. and Nitivattananon. Current Practices in Selected Southeast Asian Countries on Managing Construction and Demolition Waste. Conference on Sustainable Building South East Asia. 2007.
[17] What a Waste: A Global Review of Solid Waste Management. The World Bank. 2012
[18] Montenegro, M. Propsects on Packaging Waste Recycling in Brazil. Agencia Reguladora de Aguas, Energia e Saneamento Basico do Distrito Federal. 2012,
[19] "Steel cans - The market for recycling". Brazilian Business Commitment for Recycling (CEMPRE). Archived from the original on 25 December 2010. Retrieved 14 February 2010.
[20] http://www.recyclingproductnews.com/article/23770/canadas-packaging-recycling-rate-sees-growth
[21] Canada's Waste Management Policy: Coming in Parts but Winning Together . Global Recycling. 2017. http://global-recycling.info/archives/1448 (Accessed February 2018)
[22] Geyer, R. Production, use, and fate of all plastics ever made. Science Advances. July 2017.
[23] Nelles, M. et al. Recycling and Recovery of the biogenic fractions from municipal solid waste in the PR China. Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. 2017.
[24] https://www.forbes.com/sites/kitconews/2011/06/23/increase-in-aluminum-recycling-depends-on-china-societe-generale/#21ea43db7a07 (Accessed February 2018)
[25] Eurostat, Recovery and recycling rates for packaging. 2015. http://ec.europa.eu/eurostat/web/environment/waste/main-tables (Accessed February 2018)
[26] Kumar, S. Challenges and opportunities associated with waste management in India. Royal Society Open Society. 2017.
[27] https://www.japanfs.org/en/news/archives/news_id026840.html (Accessed February 2018)

	Other materials	21%[28]	1%	78%
Korea[29]	All	83.9%	9.4%	6.1%
United States[30]	Plastics	15%	68%	17%
	Metals	57%	34%	9%
	Pulp (cardboard, paper)	75%	20%	5%

2.8.6 WASTE CLASSIFICATION BY REGION

The following relevant legislation references shall be used by region or country:

Table 4. Waste classification by region

Country/Region	Legislation
Brazil	Annex 1-A to 1-C of the CONAMA Resolution no 23, from December 12, 1996, unless they do not present any characteristics listed in Annex II of the same legislation. Annex 10-A and 10-B of the CONAMA Resolution no 235, from January 7, 1998
China	List of Toxic Chemicals Severely Restricted on the Import and Export in China (Circular No. 65 [2005]) Measures for the Administration of Restricted Use of Hazardous Substances in Electrical and Electronic Products (Circular No. 32 [2016])
Europe	REACH Substances of Very High Concern
India	REACH Substances of Very High Concern
Japan	Hazardous wastes defined by the Basel Law are as follows: A. The following materials which are exported or imported for the disposal operations listed in Annex IV of the Basel Convention. 1. Materials listed in Annex I of the Convention and having one or more hazardous characteristics listed in Annex III of the Convention; 2. Materials listed in Annex II of the Convention; 3. Materials to be notified to the Secretariat of the Convention by the Government of Japan through the designation by the Cabinet Order in accordance with Section 1 or 2 of Article 3 of the Convention; and 4. Materials informed by the Secretariat of the Convention in accordance with Section 3 of Article 3 of the Convention. B. Materials, exportation, importation, transportation (including storage) and disposal of which must be regulated based on bilateral, multilateral or regional agreements or arrangements defined in Article 11 of the Convention.
Korea	Waste Control Act with some regulation under the Act on the Promotion of Saving and Recycling of Resources.
North America	Resource Conservation and Recovery Act (RCRA), Subtitle 3

[28] Ministry of the Environment, Waste Management and Recycling Department. History and Current State of Waste Management in Japan. 2014. https://www.env.go.jp/en/recycle/smcs/attach/hcswm.pdf (Accessed February 2018) and Presentation of Japanese technology of waste to energy. JASE world. 2012. http://www.mofa.go.jp/region/latin/fealac/pdfs/4-9_jase.pdf (Accessed February 2018)

[29] Waste Resources Management and Utilization Policies of Korea. 2016. http://www.ksp.go.kr/common/attdown.jsp?fidx=694&pag=0000700003&pid=210. Numbers do not add to 100%; 0.4% of waste is sent to sea. (Accessed February 2018)

[30] Adapted from EPA Materials Management 2014 Fact Sheet, Table 2: https://www.epa.gov/sites/production/files/2016-11/documents/2014_smmfactsheet_508.pdf (Accessed February 2018)

Southeast Asia	REACH Substances of Very High Concern

2.8.7 INCINERATION EFFICIENCY

If data are available, the efficiency of waste incineration plants (R1) shall be calculated in accordance with Annex II of the EU waste framework directive[31] as follows:

$$R1_{WIP} = \left(\left(E_{pe} \times 2.6 + E_{ph,use} \times 1{,}1\right) - \left(E_f + E_i\right)\right) / \left(0.97 \times (E_w + E_f)\right)$$

E_{pe} means annual energy produced as electricity (GJ/a)

$E_{ph,use}$ means annual energy produced as heat for commercial use (GJ/a)

E_f means annual energy input into the system from fuels contributing to the production of steam (GJ/a)

E_i means annual energy imported excluding E_w and E_f (GJ/a)

E_w means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/a)

0.97 is a factor accounting for energy losses due to bottom ash and radiation

WIP waste incineration plant

In summary, three different cases of thermal recycling of waste should be modelled and declared:

- Thermal treatment of waste, i.e. the waste flow has not reached the end of the waste status before combustion, and the incineration plant has a R1-value <0.6: the environmental loads of waste processing and incineration processes are declared as a waste disposal process in Module C4, with the exception of packaging combustion, which is to be declared in Module A5. Recovered energy due to treatment of waste is declared as exported energy in C4 and the benefits of the generated net energy is declared in Module D.
- Energy Recovery, i.e. the waste flow has not reached the system boundary between product systems before combustion, and the incineration plant has a R1 value> 0.6: the environmental impact of waste processing and incineration processes are declared as energy recovery in either A5 or C3, the Recovered energy is declared as exported energy in either A5 or C3 and the associated benefits of the generated net energy is declared in Module D.
- Energetic use of a secondary fuel, i.e. the waste flow has reached the system boundary between product systems prior to the combustion or thermal energy recovery process. This qualifies the material flow at the system boundary as a secondary fuel and the criteria of the R1 value is not applicable: the environmental impacts of any waste treatment of the future secondary fuel are accounted in A5 or C3, the material flow is

[31] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Waste Framework Directive). Available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098 (Accessed August 16 2018)

declared as a material for energy recovery in A5 or C3, and the benefits associated with the recovered energy are declared in Module D.

NOTE: The default assumption shall be thermal treatment of waste unless the proper justification can be provided for other methods with supporting documentation.

2.8.8 POWER MIX

All electricity assumptions shall be documented in the project report. The following applies as regards selecting the power mix:

- At production facilities in the US, regionally specific grid mix data on electricity shall be based on EPA's eGRID database.[32] Preference should be given to subnational consumption mixes that account for power trade between these regions. Alternatively, US production mixes of the three continental interconnections (East, West, Texas) as well as those of Hawaii and Alaska may be used.
- At production facilities in Canada, province specific grid mix data on electricity shall be based on StatCan statistics. Alternatively, production mixes of the two continental interconnections (East, West) may be used.
- At production facilities in China, region specific grid mix data on electricity shall be based on grid mixes of the State Grid Corporation of China (SGCC) or the China Southern Power Grid (CSG), depending on the provider of the facility.
- At production facilities in Brazil, India, Indonesia, Japan, Korea, Malaysia, or Thailand, country-specific grid mixes shall be based on IEA/OECD statistics.
- At production facilities outside of the countries listed above, comparable country-specific or region-specific processes shall be used provided they comply with the current state of the art.
- At production facilities in several countries, the applicable power mixes shall be assessed specifically for each country or combined weighted by production volumes in the respective countries.
- If "green" power is used, it must not be reported in inventory or impact assessment results in the LCA and EPD; results must specify the original grid source used for production. However, if there is a transparent path, such as in the EU (Guarantee of Origin), where chain of custody of green power can be traced by kwh and origin (not just CO_2e attributes), these results may be reported separately with an explanatory note stating how the green power is used in the calculations. Certificates must be available for the entire period of EPD validity. If certificates cannot be provided for the full 5 years when issuing the EPD, the program operator must request the certificates for the preceding five (5) years in order to extend the Declaration.

2.8.9 CO_2 CERTIFICATES

CO_2 certificates shall not be included in the Life Cycle Assessment but may be reported separately, apart from LCA results. The following CO_2 certificates may be recognized:

- Clean Development Mechanism (CDM) Gold Standard
- Gold Standard Verified Emission Reduction (VER)
- Voluntary Carbon Standard

[32] http://www.epa.gov/cleanenergy/energy-resources/egrid

- Verified Emission Reduction (VER)

Other certificates can be considered if they comply with the criteria on which this selection is based.

Owing to the fact that the EPDs are always valid for a period of five (5) years, the manufacturer must provide evidence of discontinuation of CO_2 pollution rights in order to obtain recognition.

CO_2 credits shall be specified separately and not reported in inventory or impact assessment results. There shall be clear delineation between the product life cycle impacts and then any carbon offsets or credits used to mitigate this impact. .

2.9 CUT-OFF RULES

[ISO 21930 Section 7.1.8 supplemented with EN 15804 Section 6.3.5]: “Criteria for the exclusion of inputs and outputs (cut-off rules) in the Life Cycle Assessment 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 procedure detailed in ISO 21930, Section 7.1.8 shall be followed for the exclusion of inputs and outputs.

Application of the cut-off criteria shall be documented in the project report:

- Description of the application of cut-off criteria and assumptions
- List of processes not taken into consideration

3 LIFE CYCLE INVENTORY ANALYSIS

3.1 DATA SELECTION, COLLECTION, AND DATA QUALITY

The requirements detailed in ISO 21930 Sections 7.1.9, 7.2.1, and 7.2.2 and EN 15804 Sections 6.3.6, 6.4.1, and 6.4.2 shall apply to the selection and collection of data used to calculate an LCA and report an EPD.

Manufacturer specific data shall be no more than five years old.

The data selection and collection procedures shall be documented in the project report.

Primary data shall be collected for every process in the product system under the control of the organization developing the LCA. Primary data shall be collected using either direct measurement or facility personnel’s best engineering estimates based on actual production if measurements are not available. The method of collection shall be specified for each process in the LCA report.

The specified secondary sources should have temporal, geographic, and technological coverage appropriate to the scope of the product category. The system boundaries of the secondary sources should be equivalent and reference flows should be adaptable to the product system specified in the PCR. Allocation procedures used in the specified secondary sources should be appropriate for the product category.

For industry-average EPDs, data shall be collected from participants in a consistent manner. All data sources shall be specified, including database and year of publication (reference).

Secondary data sources from regions other than the primary market may be used only if primary market data are unavailable in any commercial database. The substitute source shall be documented.

LCA models used to generate results for an EPD are encouraged to use unit process data sets (as opposed to system process data sets) so that the modeller may edit the underlying data in pursuit of optimizing the representativeness of the data set to the product system.

As a general rule, specific data derived from specific production processes shall be the first choice as a basis for calculating an EPD. In addition, the following rules shall apply to EPDs in accordance with this PCR:

[ISO 21930 Section 7.1.9, supplemented with EN 15804 Section 6.3.7]:

"The quality of the data used to calculate an EPD shall be addressed in the project report (see ISO 21930 Section 7.1.9, EN 15804 Clause 8, and ISO 14044 Section 4.2.3.6). In addition the following specific requirements apply for construction products:

- An EPD describing a specific product shall be calculated using specific data for at least the processes over which the manufacturer of the specific product has influence. Generic and proxy data may be used for the processes over which the manufacturer has no influence, for example processes dealing with the production of input commodities, such as raw material extraction or electricity generation, often referred to as upstream data (see following table).

Table 5. Application of generic and specific data (adapted from Table 3 in ISO 21930 Section 7.1.9)

Modules	**A1 to A3**		**A4 to A5**	**B1 to B7**	**C1 to C4**
	Production of commodities, raw materials	Product manufacture	Installation processes	Use processes	End-of-life processes
Process type	Upstream processes	Manufacturer's processes	Downstream processes		
Data type	Generic data or EPD of upstream processes See also ISO 21930 Annex B	Manufacturer's average or specific data See also ISO 21930 Annex B	Scenario based generic data based on technical information given in ISO 21930 Sections 7.1.7.3 to 7.1.7.5		

- Data shall be as current as possible. Data sets used for calculations shall have been updated within the last ten (10) years for background data and within the last five (5) years for producer-specific (foreground) data[33]. Deviations shall be justified.
- Manufacturer-specific data sets shall be based on 12 consecutive months of averaged data; deviations shall be justified in the project report. If future production conditions are to be incorporated at the time of generating the EPD, the following shall apply:
    - Processes which do not have an influence on the manufacturing process (e.g. procurement of green electricity) may be integrated in the Declaration. For green electricity, this means that the Declaration may not be issued until such a time as procurement takes place and is verified by contract.
    - For processes which have an influence on manufacturing processes (e.g. new furnace), data must be available over a certain period of time which provides a

[33] More detailed data quality requirements may be specified in a sub-category Part B PCR, e.g. providing specific requirements for primary or secondary data.

representative set of data for the new process. This need not be a full year; 3-4 months often suffices in this case.

[ISO 21930 Section 7.1.9, supplemented with EN 15804 Section 6.3.7]:

- 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. A longer time period shall be used if relevant and shall be justified in the project report;
- Emissions from a landfill should be accumulated over 100 years after the material was deposited on or in the landfill.
    - NOTE Long-term emissions are considered emissions occurring beyond 100 years after the material was deposited on or in the landfill.
- The technological coverage shall reflect the physical reality for the declared product or product group;
- Generic data: Guidance for the selection and use of generic data is provided in CEN/TR 15941. Generic data shall be checked for plausibility.
- Data sets shall be complete according to the system boundaries and criteria for the exclusion of inputs and outputs (see EN 15804 Section 6.3.5).

3.1.1 DATA QUALITY EVALUATION

An evaluation of data quality, including temporal, geographical, technological representativeness, and completeness, shall be included in the project report.

If the data quality assessment gives sufficient reason to believe that any of the employed generic material or process LCI data is not representative of the product(s) under study and may introduce error to the reported impact category results, then a reasonable effort shall be made by the declaring organization to improve the data quality either by 1) collecting primary data on the material or process in question from suppliers or process operators, 2) developing LCI data based on other data sources like scientific literature, equipment specs, or trade publications, or 3) assessing whether more representative LCI data is available from any of the sources listed in Section 3.1.2. If none of these options is viable within given constraints, the source and nature of the expected error shall be documented in the project report and a disclaimer should be added to the EPD that the reported values are likely an over- or underestimate of potential environmental burdens.

3.1.2 BACKGROUND DATA

Until pre-verified generic data sets are available as per EN 15804 and CEN/TR 15941, the following rules shall apply for selecting the background data base:

- As a general rule, consistent background data should be used in order to ensure comparability of results.
- The following databases[34] may be used:
    - NREL US LCI / LCA Digital Commons (https://www.lcacommons.gov)
    - European/International Life Cycle Database (http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm)
    - GaBi[35] (http://www.gabi-software.com/databases)

[34] All databases in this list were Accessed 10 August 2018.

[35] Companies operating in Germany shall use the GaBi database for energy, transport and auxiliaries if intending to register EPDs in the German national EPD database. Data on ancillary materials produced in Germany can also be taken from the

- ecoinvent (www.ecoinvent.ch)
- WorldSteel database (https://www.worldsteel.org/steel-by-topic/life-cycle-thinking.html)
- WorldAluminum database (http://www.world-alumini-um.org/media/filer_public/2018/02/19/lca_report_2015_final_26_june_2017.pdf)
- eBalance (http://support.ike-global.com/downebalancefree)
- AusLCI (http://www.auslci.com.au/)
- Agri-footprint (http://www.agri-footprint.com/)

- A third party verified ISO 14040/44 conforming report shall be available for all secondary data sets with the exception of the databases listed above (either at the unit process level or in aggregate) that contribute to more than two-thirds (67%) of total impact to any of the required impact categories identified by the applicable PCR.

The project report shall:

- Indicate the data sets used and sources (e.g., name of database, literary source), including the year for which the data set is representative
- Document the representativeness of data sets used
- Document the treatment of missing data
- Evaluate data quality

3.2 CALCULATION PROCEDURES

Calculation procedures described in ISO 14044 and referenced in ISO 21930 Section 7.2.2 and EN 15804 Section 6.4.2 shall apply. All calculation procedures shall be applied consistently throughout the LCA.

When transforming the inputs and outputs of combustible materials into energy, the lower caloric value of fuels (LHV) shall be applied according to scientifically based and accepted values specific to the combustible material.

3.3 ALLOCATION

Allocation procedures for co-products and between product systems shall be addressed according to ISO 21930, Sections 7.2.4, 7.2.5, and 7.2.6 and EN15804, Sections 6.4.3.1 and 6.4.3.2. Generally speaking, allocation shall be avoided by dividing unit processes into sub-processes that can be allocated to co-products and by then collecting the input and output data related to these sub-processes.

- Unless specified otherwise in a sub-category Part B PCR, 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;

Ökobaudat database (http://www.nachhaltigesbauen.de/baustoff-und-gebaeudedaten/oekobaudat.html). Accessed 10 August 2018.

- 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 processes.

- Impacts from allocated co-products shall not be included in module D.

- System expansion (the approach of expanding the product system to include the additional functions related to the coproducts) is not considered as an option for avoiding allocation within EPD studies. It shall not be used to avoid the allocation of impacts to any co-products which are produced or used in the manufacture of construction products

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 of 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 Part A PCR 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 Part A PCR."

3.3.1 Allocation Between Product Systems (Across the System Boundary)

[ISO 21930 Section 7.2.6] "The allocation procedure for flows crossing the system boundary between product systems (allocation to recycling) is simple. No burdens are allocated across the system boundary with secondary material, secondary fuel, or recovered energy flows arising from waste."

It is important to note that "Module D does not show allocated impact and is not a form of allocation as there is no allocation of burdens across the system boundary."

[EN15804 Section 6.4.3.3]: "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[36] 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 […], informative Module D declares potential benefits or avoided loads of secondary material, secondary fuel or recovered energy leaving the product system. Module D recognizes the "design for reuse, recycling and recovery" concept for construction works 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."

[36] See footnote 1.

NOTE 1: Module D also contains benefits from recovered energy exported from waste disposal processes declared in Module C4 and A5.

Where a secondary material or fuel crosses the system boundary 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 that substitutes primary material based on the current technology mix for the material.

In Module D, the impacts of net output flows 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 up to the point of functional equivalence where the secondary material or fuel 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 substitution process.

In Module D substitution effects are only calculated 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 a 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 […]."

When selecting the substituted processes, the following shall apply for packaging energy utilization (Also see Section 2.8.4.2):

- For production locations in the US, regionally specific inventory data on electricity based on the current version of EPA's eGRID database shall be used. Preference should be given to subnational consumption mixes that account for power trade between these regions. Alternatively, US production mixes of the three continental interconnections (East, West, Texas) as well as those of Hawaii and Alaska may be used. Substituted thermal energy shall be accounted for as thermal energy from natural gas, indicating the year of reference.
- In the case of production facilities in Germany, the current average "Strom Deutschland" index shall be used for power and the "Thermal energy from natural gas" index for heat, indicating the year of reference.
- In the case of production facilities in Brazil, China, India, Japan, Korea, or Southeast Asia, refer to Section 2.8.8 for electricity requirements. Substituted thermal energy

shall be accounted for as global average thermal energy from natural gas, indicating the year of reference.
- For production locations outside of the countries and region listed above, the respective location where energy is provided must be taken into consideration.

When selecting the substituted processes, the following end-of-life scenario shall apply for energetic utilization of the product:

- In the case of a primary market in the US, regionally specific inventory data on electricity based on the current version of EPA's eGRID database shall be used. Preference should be given to subnational consumption mixes that account for power trade between these regions. Alternatively, US production mixes of the three continental interconnections (East, West, Texas) as well as those of Hawaii and Alaska may be used. Substituted thermal energy shall be accounted for as thermal energy from natural gas, indicating the year of reference.
- In the case of a primary market in Germany, the current average "Strom Deutschland" index shall be used for power and the "Thermal energy from natural gas" index for heat, indicating the year of reference.
- In the case of a primary market Brazil, China, India, Japan, Korea, or Southeast Asia, refer to Section 2.8.8 for electricity requirements. Substituted thermal energy shall be accounted for as global average thermal energy from natural gas, indicating the year of reference.
- For production locations outside of the countries and region listed above, the respective location where energy is provided must be taken into consideration.

3.3.2 Description of Allocation Processes in the Project Report

Allocations performed must be described in the project report, at least (if relevant):

- Allocations when using secondary materials as raw materials
- Allocations in the plant (differentiation from other products manufactured in the plant)
- Allocation of multi-input processes if performed during modelling
- Allocations of reuse, recycling and energy recovery

The allocation processes selected must be justified and the allocation factors used must be confirmed by independent sources.

Uniform application of the allocation rules must be documented.

3.4 Description of the Unit Processes in the Project Report

The project report must transparently document the unit process modelling in the LCA. With regards to data confidentiality, relevant confidential information shall be shared for verification purposes and kept confidential by the Program Operator. The report may not include confidential information for communication with third-parties.

Documentation may be done in a tabular form or as flow charts (e.g. screenshots from LCA software), whereby the following must be clarified:

- Attribution of company data to LCI background data sets
- Allocation of process data to the life cycle modules in the LCA

If several products are declared in a single EPD or if a product is manufactured at several locations, modelling must be described for each product and/or location and the weighing of data sets documented.

4 LIFE CYCLE INVENTORY AND IMPACT ASSESSMENT RESULTS

The results of the Life Cycle Assessment must be described in the project report in tabular form for all Modules A1 to D. The Life Cycle Inventory Analysis indicators to be declared and the estimated impacts shall also be indicated.

If individual modules or entire life cycle stages are not declared, the corresponding fields in the table must be marked as “MND” (module not declared).

4.1 LIFE CYCLE INVENTORY INDICATORS PER ISO 21930 AND EN 15804

[ISO 21930 Section 7.2.10]: “Parameters to describe the use of resources:

The following environmental parameters use data from the inventory analysis. They describe the use of renewable and non-renewable material resources, renewable and non-renewable primary energy and water. The parameters are required and shall be specified in the EPD according to Table 6, adapted from ISO 21930, Section 7.2.10. Refer to the ACLCA ISO 21930 Guidance document[37] for further calculation instructions.

Table 6. Life Cycle Inventory Results: Resource Use[38]

Parameter	Description	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	(First use) bio-based materials used as an energy source. Hydropower, solar and wind power used in the technosphere are also included in this indicator	[MJ]
RPR_M: Renewable primary resources with energy content used as material	(First use) biobased materials used as materials (e.g. wood, hemp, etc.).	[MJ]
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	(First use) materials such as peat, oil, gas, coal, uranium used as an energy source.	[MJ]
$NRPR_M$: Non-renewable primary resources with energy content used as material	(First use) primary resources such as oil, gas and coal, used for products (e.g. plastic-based products).	[MJ]
SM: Secondary materials	Materials recycled from previous use or waste (e.g. scrap metal, broken concrete, broken glass, plastic and wood) that are used as a material input from another product system. These include both renewable and non-renewable resources, with or without energy content, depending on the status of the material when it was originally extracted from the environment	[kg]
RSF: Renewable secondary fuels	Renewable materials with energy content that have crossed the system boundary between product systems and are used as fuel input (energy source) in another product system (e.g. biomass residue	[MJ]

[37] Available at https://aclca.org/aclca-iso-21930-guidance/

[38] EN 15804 Section 7.2.4 requires the additional reporting of parameters RPR_T (Total use of renewable primary resources with energy content) and $NRPR_T$ (Total non-renewable primary resources with energy content). $RPR_T = RPR_E + RPR_M$, and $NRPR_T = NRPR_E + NRPR_M$. For conformance with ISO 21930:2017, these parameters shall not be reported and are not included in Table 6.

	pellets, chipped waste wood).	
NRSF: Non-renewable secondary fuels	Non-renewable materials with energy content that have crossed the system boundary between product systems and are used as fuel input (energy source) in another product system (e.g. processed solvents, shredded tyres).	[MJ]
RE: Recovered energy	Energy recovered from disposal of waste in previous systems, such as energy recovery from combustion of landfill gas or energy recovered from other systems using energy sources.	[MJ]
FW: Use of net fresh water resources	See Section 4.1.1 below	[m^3]

NOTE 1: In order to identify the input part of renewable/non-renewable primary energy used as an energy carrier and not as a raw materials, the parameter "use of renewable/non-renewable primary energy excluding the renewable/non-renewable primary energy resources used as raw materials" parameter is considered and can be calculated as the difference between the total input of energy resources and the input of primary energy resources used as a raw materials.

The use of the primary energy, which is used as raw material, is calculated as the energy content from the mass of the components (content composition) multiplied with the respective lower calorific value (LHV) of the components.

4.1.1 FRESHWATER CONSUMPTION

Net freshwater consumption shall be reported as an LCI indicator and calculated according to ISO 14046. Net freshwater is equal to consumptive freshwater use (freshwater consumption), and should not consider water which is not consumed.

The parameter contains: evaporation (e.g. cooling towers), evapotranspiration (evaporation of irrigated water), embedded freshwater (e.g. concrete), drainage of freshwater into the ocean.

Further guidance is provided in ISO 21930, Section 7.2.13, and additional calculation guidance may be provided in a sub-category Part B PCR.

4.1.2 WASTE CATEGORIES AND OUTPUT FLOWS

The indicators describing waste categories and other material flows are output flows derived from LCI and shall be reported according to ISO 21930 Section 7.2.14 and EN15804 Section 7.2.5. They shall be included in the EPD as follows:

Table 7. Life Cycle Inventory Results: Output Flows and Waste Categories

Parameter	Parameter	Unit
HWD	Hazardous waste disposed	[kg]
NHWD	Non-hazardous waste disposed	[kg]
HLRW	High-level radioactive waste, conditioned, to final repository	[kg] or [m^3]
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	[kg] or [m^3]
CRU	Components for re-use	[kg]

MR	Materials for recycling	[kg]
MER	Materials for energy recovery	[kg]
EE	Recovered energy exported from the product system	MJ, heating value ([Hi] lower heating value) per energy carrier

"Hazardous waste disposed" is the amount of hazardous waste that is disposed according to the Section 2.8.4.5, Table 4. Radioactive waste is not included.

"Non-hazardous waste disposed" is the amount of non-hazardous waste that is disposed.

"Radioactive waste disposed" is the amount of radioactive waste that is disposed. High-level radioactive waste, e.g., when generated by electricity production, consists mostly of spent fuel from reactors. Low- and intermediate-level radioactive wastes, e.g., when generated by electricity production, arise mainly from routine facility maintenance and operations.

See ISO 21930 Section 7.2.14, Table 4 for how to assign output flows to information modules C1-C4.

The output material flows are declared in the module from which they cross the system boundary, as a rule when they reach the system boundary between product systems.

NOTE: For the calculation and communication of indicators on environmental aspects:

As long as the LCA software used does not allow distinguishing the ***primary energy used as raw material or as energy carrier,*** it is permissible to calculate the primary energy as a fuel source across modules A1-A3 as the difference between primary energy and primary energy used as a raw material, where primary energy used as a raw material is calculated based on the product material composition and corresponding LHVs. When communicating the values in the EPD, this shall be indicated by the design of the frame in the table.

As long as the used LCA software does not allow calculating the ***use of secondary materials or secondary fuels*** directly, it is permissible to declare these indicators based on available information from the main system (i.e. manufacturer´s data) as a minimum value.

The indicators may be declared for the production stage across the modules A1-A3. When communicating the values in the EPD, this is to be indicated by the design of the frame in the table.

4.2 Accounting for Biogenic Carbon Uptake and Emissions

See ISO 21930 Section 7.2.7, for requirements on accounting for the biogenic carbon removal(s) and emissions of the product system in the form of mass flows to and from nature. The amount of biogenic carbon contained within the packaging material shall be included in the scenario information for Module A5. The amount of biogenic carbon removed via the declared unit of product shall be documented in the scenario information at end-of-life. In both instances, biogenic carbon shall be expressed as kg CO_2.

4.3 Accounting for Calcination and Carbonation

According to ISO 21930 Section 7.2.8, “Carbonation is the reaction of atmospheric carbon dioxide with calcium oxide or calcium hydroxide containing products to form calcium carbonate.[…] Environmental impacts considered during the production, use and end-of-life stages shall include carbonation as detailed in ISO 21930, Section 7.2.8. More detailed guidance and requirements may be provided in a sub-category Part B PCR.

4.4 Accounting of Delayed Emissions

Per ISO 21930 Section 7.2.9, there is no consensus of approaches to address delayed emissions in the calculation of GWP. “If a manufacturer wishes to declare quantitative or qualitative information on delayed emissions within the EPD, the information shall be reported under “Additional environmental information not derived from LCA” (see ISO 21930, Section 9.6) and the underlying methodology shall be referenced.” More detailed guidance and requirements may be provided in a sub-category Part B PCR.

4.5 Greenhouse Gas Emissions from Land-Use Change

Per ISO 21930 Section 7.2.11, “When significant, the greenhouse gases (GHG) emissions occurring as a result of land-use change shall be included in the quantification of the GWP. They should be assessed in accordance with internationally recognized methods such as the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories.

This contribution to GWP shall be declared separately in the EPD as GWP (land-use change) as additional environmental information, including a short interpretation of the data.

The project report shall include an interpretation of the results reflecting the influence of data availability and the underlying methodology shall be referenced.”

Refer to ISO 21930, Section 7.2.11, for further considerations.

More detailed guidance and requirements may be provided in a sub-category Part B PCR.

4.6 Carbon Emissions and Uptake

[ISO 21930, Section 7.2.12]: “For transparency, the following indicators on the uptake and emissions of CO_2 shall be separately reported, where relevant and available, if included in the quantification of the GWP:

Table 8 shall be included in an EPD if included in the GWP calculation.

Table 8. Carbon Emissions and Removals

Parameter	Parameter	Unit
BCRP	Biogenic Carbon Removal from Product	[kg CO_2]
BCEP	Biogenic Carbon Emission from Product	[kg CO_2]
BCRK	Biogenic Carbon Removal from Packaging	[kg CO_2]
BCEK	Biogenic Carbon Emission from Packaging	[kg CO_2]
BCEW	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	[kg CO_2]
CCE	Calcination Carbon Emissions	[kg CO_2]
CCR	Carbonation Carbon Removals	[kg CO_2]
CWNR	Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	[kg CO_2]

4.7 Life Cycle Impact Assessment Indicators for North America

The following information on environmental impacts is expressed by the impact category indicator results using characterization factors based on the current version of U.S. EPA’s

Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts[39] (TRACI). These predetermined parameters are required and shall be included in the EPD, at a minimum, as follows:

Table 9. NORTH AMERICAN LIFE CYCLE IMPACT ASSESSMENT RESULTS

Impact Category	Units
Global Warming Potential (GWP 100)	[kg CO_2 eq]
Ozone Depletion Potential (ODP)	[kg CFC 11 eq]
Acidification Potential (AP)	[kg SO_2 eq]
Eutrophication Potential (EP)	[kg N eq]
Smog Formation Potential (SFP)	[kg O_3 eq]
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil})	[MJ, LHV]

The table shall be preceded by a statement that "LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks."

It is further encouraged that additional impact measures be included in the product LCA in order to obtain a more complete understanding of environmental hot-spots for the industry being studied. Additional impact measures are encouraged to be reported with the below statement:

The EPD shall contain the following language, "These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes."

Toxicity impacts shall be reported under "Additional Environmental Information". If toxicity is included, USEtox[40] indicators shall be used and reported only as a percentage contribution analysis.

A sub-category Part B PCR may provide further requirements on the inclusion of other impact categories and methods to be included as additional environmental information.

Impact results may also be included for more than one characterization method as long as they are reported separately from the default TRACI values.

4.8 LIFE CYCLE IMPACT ASSESSMENT INDICATORS FOR EUROPE

For conformance with EN 15804 in European markets, LCIA results shall be reported as follows using the characterization factors CML-IA version 4.2 from April 2013[41].

[EN15804, Section 7.2.3]: "The following information on environmental impacts is expressed by the impact category parameters of LCIA using characterization factors. These predetermined parameters are required and shall be included in the EPD as follows:

[39] https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci. (Accessed on 16 August 2018.)
[40] USEtox is available in TRACI and at http://www.usetox.org/ (Accessed on 16 August 2018.)
[41] https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors (Accessed on 16 August 2018.)

Table 10. EU LIFE CYCLE IMPACT ASSESSMENT RESULTS

Impact Category	Units
Global Warming Potential (GWP 100)	[kg CO_2 eq]
Depletion potential of the stratospheric ozone layer (ODP)	[kg CFC-11 eq]
Acidification Potential of soil and water (AP)	[kg SO_2 eq]
Eutrophication Potential (EP)	[kg $(PO_4)^{3-}$ eq]
Photochemical Oxidant Creation Potential (POCP)	[kg ethane eq]
Abiotic depletion potential (ADP-elements) for non-fossil resources*	[kg Sb eq]
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ, calorific value ([Hi] lower calorific value)]

NOTE 1: The indicator describing the depletion of elemental abiotic resources is subject to further scientific development. The use of this indicator is intended to be reviewed during the revision of this PCR. The reporting of this category in ISO 21930 is optional per Section 7.3.

[EN15804, Section 6.5]: "The characterisation factors of the European Reference Life Cycle Data Base[42] (ELCD) are used taking consideration of the respective ELCD updates.

The characterisation factors for the use of abiotic resources must be taken from the CML. The characterisation factor for the use of abiotic resources (fossil substances) is the respective calorific value ([H_i] lower calorific value) at the fossil fuel extraction point."

The characterization factors CML-IA version 4.2 from April 2013 apply (Institute of Environmental Sciences, Faculty of Science University of Leiden, Netherlands), which are identified as "base-line". The respective indication of the used characterization factors shall be given in the project report and in the EPD.

Long-term emissions (>100 years) are not taken into consideration in the impact estimate.

Apart from the results of the impact estimate, the following must also be indicated in the project report:

- Reference to all characterization models, characterization factors and methods used, as defined in this document
- A statement that the impact estimate results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks

A sub-category Part B PCR may provide further requirements on the inclusion of other impact categories and methods to be included as additional environmental information.

Impact results may also be included for more than one characterization method as long as they are reported separately from the default CML values.

4.9 INTERNATIONAL LIFE CYCLE IMPACT ASSESSMENT INDICATORS

The following default international characterization methods shall be included for EPDs intended primarily for markets outside of North America and Europe, and may be optionally included for all other EPDs:

[42] http://eplca.jrc.ec.europa.eu/ELCD3/ (Accessed on 16 August 2018.)

Table 11. REST OF WORLD LIFE CYCLE IMPACT ASSESSMENT RESULTS

Impact category and abbreviation	Method
Global warming potential (GWP 100)	IPCC
Ozone depletion potential (ODP)	WMO
Eutrophication potential (EP)	Heijungs et al.
Acidification potential (AP)	Hauschild and Wenzel
Photochemical oxidant creation potential (POCP)	Jenkin and Hayman

Characterization factors of the Default International Characterization Method are publicly available on http://cml.leiden.edu/software/data-cmlia.htm.

The table shall be preceded by a statement that "LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks."

A sub-category Part B PCR may provide further requirements on the inclusion of other impact categories and methods to be included as additional environmental information.

Impact results may also be included for more than one characterization method as long as they are reported separately from the default method.

4.10 OPTIONAL LCIA INDICATORS AND OTHER ADDITIONAL ENVIRONMENTAL INFORMATION

Unless otherwise defined explicitly in the sub-category Part B PCR, an EPD may also include impact categories as defined in ISO 21930 Section 8.2 as "still under development or have high levels of uncertainty that preclude international acceptance pending further development. Such potential LCIA categories shall follow the requirements for characterization models given in ISO 14044. The following are examples of such potential impact categories: "[…]

- Abiotic depletion potential for non-fossil mineral resources ($ADP_{elements}$)
- Land-use-related impacts, for example on biodiversity and/or soil fertility
- Toxicological aspects.

If such LCIA-type results are included in an EPD, the LCA report and the EPD shall include a written discussion of the results, including the limitations related to the LCIA-type methods used. This requirement also applies to the development of sub-category Part B PCR."

Additional environmental information may also be included of a qualitative nature, such as those in ISO 21930 Section 8.3:

- "Geographical aspects relating to the declared environmental aspects at any stages of the life cycle
- Environmentally responsible sourcing
- Best environmental practice
- Energy use for operating pollution control systems
- Toxicity risks or hazards related to human health and/or the environment."

4.11 MANDATORY ENVIRONMENTAL INFORMATION

4.11.1 REGULATED HAZARDOUS SUBSTANCES

EPDs shall list, at a minimum, all substances contained in the construction product that are identified as hazardous according to standards or regulations of the applicable market(s) in Section 2.8.4.5, Table 4. Waste classification by regionFor products where no such sub-

stances are present, the EPD shall include the statement “no substances required to be reported as hazardous are associated with the production of this product.”

4.11.2 DANGEROUS SUBSTANCES

EPDs shall contain mandatory information about the release of dangerous, regulated substances that affect health and environment according to the relevant market of applicability. A sub-category Part B PCR shall provide further requirements on testing and reporting the releases of dangerous substances to be included in this Section. According to ISO 21930 Section 8.4.2, this includes but is not limited to:

- Indoor air emissions
- Gamma or ionizing radiation emissions
- Chemicals released to air or leached to water and soil

4.12 UNITS

The International System of Units (SI units) required for all LCA results. Other units commonly used in a regional market may be optionally included in addition to the required SI units.

Table 12. Mandatory conversion factors to be used if optionally reporting in Imperial units

Convert from	To	Multiply by
square meter (m^2)	Square foot (ft^2)	10.76391
kilogram (kg)	Pound (lb)	2.204622
Mega joule (MJ)	British Thermal Unit (BTU)	947.8170
degree Celsius (°C)	degree Fahrenheit (°F)	t/°C = (t/°F - 32)/1.8
cubic meter (m^3)	cubic foot (ft^3)	35.31466

5 LIFE CYCLE INTERPRETATION

The aggregation factors of the Life Cycle Inventory Analysis and the estimated impact indicators shall be interpreted in the project report with reference to the declared or functional unit and specifications essentially influencing the result, i.e. at least:

[ISO 21930 Section 10.2 f and EN15804 Section 8.2]: […]

- “[Interpretation of] the results [based on a dominance analysis of selected indicators (for the relevant modules)];
- [The relationship between the Life Cycle Inventory Analysis results and the results of the impact estimate];
- Assumptions and limitations associated with the interpretation of results as declared in the EPD, both methodology and data related;
- 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;
- Data quality assessment;
- Full transparency in terms of value-choices, rationales and expert judgements.”

6 DOCUMENTATION OF ADDITIONAL INFORMATION

6.1 LABORATORY RESULTS AND SCENARIO-RELATED INFORMATION

[ISO 21930 Section 10.4 and EN15804 Section 8.3]: "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/measurements 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 construction works (e.g. transport distances, 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."

6.2 DOCUMENTATION FOR CALCULATING THE REFERENCE SERVICE LIFE (RSL)

If the use stage is declared (Modules B1 to B7), a reference service life (RSL) must be indicated. In all other cases, indication of a RSL is optional.

[ISO 21930, Section 7.1.4]: "The RSL information to be declared in an EPD covering the use stage shall be provided by the manufacturer. The RSL shall refer to the declared technical and functional performance of the product within a construction works. It shall be established in accordance with any specific rules given in product standards and shall take into account ISO 15686-1, ISO 15686−2, ISO 15686−7 and ISO 15686−8. Where product standards provide guidance on deriving the RSL, such guidance shall have priority.

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

Default values shall be provided and be based on published references. If longer RSLs are used, they shall be guaranteed by the signature of the most senior officer of the product manufacturer."

NOTE Default values can be provided in a sub-category Part B PCR.

Requirements and guidance on both the RSL and ESL for the estimation of service life are given in normative ISO 21930, Annex A. A sub-category Part B PCR should specify requirements to define the RSL for the given product group, where relevant.

6.3 DATA AVAILABLE FOR VERIFICATION

The information listed in ISO 21930 Section 10.5 shall be made available to the verifier, taking into account data confidentiality specified in ISO 21930 Section 10.3.

7 EPD Reporting Requirements

The following information shall be reported when creating an EPD using this Product Category Rule.

7.1 Declaration of General Information

The following verification information shall be declared and presented in the EPD, according to ISO 21930 Section 9.2:

ISO 21930:2017 – serves as the core PCR and UL Part A:

- **Sub-category Part B PCR, if relevant**
- **PCR review was conducted by:**
- **Sub-category Part B PCR review was conducted by:**
- **Name and organization of the panel chair, and their contact information**

Independent verification of the declaration and data, according to ISO 21930:2017, UL Part A, and ISO 14025:2006

□ internal □ external

Third party verifier:

- **Name of third party verifier**

The following general information shall be declared:

- Name and address of the EPD holder(s) (manufacturer, association, service provider, etc
- Declaration number
- Name of EPD program and program operator name, address, logo and website
- Reference to General Program Instructions and version number
- Reference to ISO 21930:2017, Part A PCR and sub-category (Part B) PCR, along with version numbers, publisher, and year published
- Declaration date of issue and period of validity
- Market(s) of applicability
- EPD scope: cradle to gate, cradle to gate with options (specify options), or cradle to grave
- The site(s), manufacturer or group of manufacturers or those representing them for whom the results of the LCA are representative
- Designation as Industry Average or Manufacturer Specific EPD
- Description of the product's intended application and use (as identified when determining the product RSL), where relevant
- The functional or declared unit

- Description of the product RSL, if applicable
- Product identification by name (including production code) and a simple visual representation of the product to which the EPD is developed
- A description of the main product components or material that make up the construction product or work, given in percentage
- A diagram of the life cycle stages included in the LCA reported according to A, B, C, and D modules per ISO 21930 and EN 15804:
    - Product and Installation (Modules A1-A5)
    - Use (Modules B1-B7)
    - End of life (Modules C1-C4)
- For cradle-to-gate EPDs, additional required production information
- Range of dataset variability (industry-wide EPDs only; mean, median, and standard deviation)
- Year(s) of reported manufacturer primary data
- LCA software used and version number
- LCI database(s) used and version number
- LCIA methodology and version number
- PCR, LCA, and EPD verification information
- Any other environmental certification program applied to the product and a statement on where an interested party can find details of the certification program, if relevant;
- Other environmental activities of the organization, such as participation in recycling or recovery programs, provided that the details of these programs are readily available to the purchaser or user and contact information is provided, if relevant;
- Information on where explanatory material may be obtained
- The following statements or equivalent statements:
- Environmental declarations from different programs (ISO 14025) may not be comparable.
    - “Comparison of the environmental performance of [Product category] using EPD information shall be based on the product’s use and impacts at the construction works level, and therefore EPDs may not be used for comparability purposes when not considering the construction works energy use phase as instructed under this PCR”.
    - “Full conformance with the PCR for [Product category] allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same sub-category Part B PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible”. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.
- Any comparability limitations.

7.2 Declaration of Methodological Framework

Per ISO 21930 Section 9.3, the EPD shall specify the following:

- Functional unit or declared unit depending on type of EPD;
- Type of EPD with respect to life cycle stages covered as given in Section 2.8.1;
- Life cycle stages covered and not covered;
- For declarations representing an average of similar products from the same or different manufacturer, a description of what the average represents as stated in Section 2.5;
- Reference conditions for achieving the declared technical and functional performance and the RSL, where relevant as described in Section 2.8.2;
- Allocation procedure;
- Cut-off procedure;
    - Include the statement “No known flows are deliberately excluded from this EPD”
- Declaration of technical information and scenarios
- If applicable, include the statement that third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impact (either at the unit process level or in aggregate) to any of the required impact categories identified by the applicable PCR.

7.3 Declaration of Technical Information and Scenarios

All information per ISO 21930 Section 9.4 shall be provided in the EPD and is included in the sub-category Part B PCR.

7.4 Declaration of Environmental Parameters Derived From LCA

Environmental parameters shall be declared per ISO 21930 Section 9.5.

- LCA results from LCIA:
    - Required environmental impact indicators and Impact Assessment (IA) methodology from Sections 4.7, 4.8, and/or 4.9
    - Optional environmental impact indicators and IA methodology from Section 4.10
- LCA results from LCI:
    - Required resource parameters Section 4.1
    - Required waste parameters from Section 4.1.2
    - Required carbon emissions from Section 4.6

7.5 Declaration of additional environmental information

Per ISO 21930 Section 9.6, EPDs shall list the information in Sections 4.11.1 and 4.11.2 for regulated hazardous and/or dangerous substances.

Regulated substances of very high concern shall be declared, according to the markets for which the EPD is valid. Reporting of substances of very high concern shall include:

- A description of the regulated substance,
- The chemical abstracts service (CAS) number, and
- A reference to standard(s) or regulation(s) applicable for the relevant market.

Optional environmental information not derived from LCA is to be reported here together with a short interpretation and statement of possible limitations of the results (see Section **Error! Reference source not found.**).

- Organization's adherence to any environmental management system, with a statement on where an interested party can find details of the system, if relevant.
- Instructions and limits for correct use, if relevant.

7.6 REFERENCES

A list of references used shall be provided.

8 FURTHER EPD REQUIREMENTS

8.1 EPD OWNERSHIP, LIABILITY AND RESPONSIBILITY

Per ISO 21930 Section 5.4 and EN 15804 Section 5.5, a manufacturer or a group of manufacturers are the sole owners and have liability and responsibility for an EPD, including but not limited to insuring industry wide and manufacturer specific EPD updates are made based on the most recent LCA modelling software version and impact assessment version available.[43] Only the manufacturer or group of manufacturers is authorized to declare the environmental performance of the construction product using an EPD.

8.2 CONTENT OF EPD

Critical, comparative, or promotional texts are not permitted unless specifically required by this PCR or if necessary in the context of the EPD.

8.3 VERIFICATION

An EPD created using this PCR shall be verified by a qualified independent third party acting in accordance with ISO 14025. The project report shall be made available for the verification process as required in Section 2.

8.4 VALIDITY

An industry-average or manufacturer-specific EPD created using this PCR is valid for a five (5) year period from the date of issue, unless specified otherwise in a sub-category Part B PCR. EPDs shall only be updated at the end of the validity period if changes occur to technology affecting the product system or per other issues identified in the sub-category Part B PCR. If the underlying LCA data have not changed significantly (as a general rule, +/- 10% for any given impact category), a data refresh will not necessarily be required.

8.5 COMPARABILITY

EPDs shall not contain statements of the superiority of one product over a competitive product that performs the same functions, or of one manufacturer against another. EPDs shall not

[43] The requirement to use most recent LCA modelling software version and impact assessment version available does not necessarily apply when EPD updates are made during the EPD's period of published validity; i.e. before EPD expiration. This includes, but is not limited to, updates made to include new manufacturer data.

contain directly or indirectly such comparative assertions. For more information on comparability between non-competitive products, refer to Section 9.

The following ISO statements indicate the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on this PCR. ISO 14025 requires this statement be included: “Environmental declarations from different programs based upon differing PCRs may not be comparable”.

A statement shall be included that indicates, “comparison of the environmental performance of construction works and construction products using EPD information shall be based on the product’s use and impacts at the construction works level. In general, EPDs may not be used for comparability purposes when not considered in a construction works context. Given this PCR ensures products meet the same functional requirements, comparability is permissible provided the information given for such comparison is transparent and the limitations of comparability explained.”

This statement shall be included: “When comparing EPDs created using this PCR, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.”

The EPD owner shall transparently indicate any comparability limitations.

9 COMPARABILITY AND BENCHMARKING OF EPDS

9.1 BENCHMARKING IN EPDS

Benchmarking results may be included in an EPD according to the requirements listed in the Sections below.

9.2 INDUSTRY-AVERAGE BENCHMARKING

When a manufacturer-specific EPD is benchmarked against an industry-average EPD, the following requirements shall be met, in addition to the comparability requirements listed in ISO 21930 Section 5.5.

- If the industry association has a developed dedicated LCA and EPD generator tool, this tool shall be used for all EPD comparisons.
- A manufacturer shall have participated, either originally or retroactively, in the industry-average EPD per the requirements outlined in this Part A PCR and potential additional requirements provided in a sub-category Part B PCR.

NOTE: Industry associations may want to provide a pathway for manufacturers to claim representation under a previously published industry average EPD, or claim “retroactive participation”, regardless of why the manufacturer did not/was not able to originally participate. As such, sub-category Part B PCRs may specify any quantitative LCI/process data and qualitative data that must be submitted for a manufacturer to claim representation. These criteria may differ depending on the industry and their level of comfort. These submitted data are then reviewed by the Program Operator, which then confers with the industry association to reach consensus as to whether the manufacturer can be added. That said, the LCA report submitted to the Program Operator by the LCA practitioner must contain the uncertainty ranges for key LCI manufacturing and product data in order to make this determination.

EXAMPLE PART B RETROACTIVE PARTICIPATION SECTION:

A manufacturer requiring retroactive inclusion in the industry average EPD shall provide the manufacturing and product data information submitted in the original industry average EPD to the LCA practitioner. The LCA practitioner will then recommend to the Program Operator a determination for inclusion in the industry average on the basis of results validation for any impact category. The maximum and minimum results should be reported in the LCA background report for each impact category based on the highest and lowest impact product within the original industry-wide LCA.

When determining a manufacturer's participation eligibility, the EPD Program Operator shall follow the recommendations of the primary sponsor(s) of the industry average EPD and participating manufacturers unless the Program Operator has information to the contrary, in which case the Program Operator, LCA practitioner, primary sponsor of the industry average EPD, and manufacturer shall confer in an effort to reach consensus.

- LCI data sources shall be consistent between the manufacturer-specific EPD and the industry-average benchmark EPD as it pertains to:
    - Background life cycle inventory data sets and reference year:
        - If a manufacturer-specific EPD is developed using the same LCI dataset(s) and version as the industry-average, then no recalculation is required and comparison may proceed.
        - If the LCI dataset(s) used in the industry-average and manufacturer-specific EPDs are different, the industry average EPD results shall be recalculated using the LCI dataset(s) used for manufacturer-specific EPD.
    - Priority of primary and secondary data sources.
    - Specific primary, non-life cycle inventory data (e.g. transportation distances and modes)
- A data quality check should be based on a plausibility check.
- LCA modelling software and version shall be consistent:
    - If a manufacturer-specific EPD is developed using the same LCA software platform and version as the industry-average, then no recalculation is required and comparison may proceed.
    - If the LCA software platforms used in the industry-average and manufacturer-specific EPDs are different, the industry average EPD results shall be recalculated using the software platform and version used for manufacturer-specific EPD.
- Life Cycle Impact Assessment method and version shall be consistent between the manufacturer-specific EPD and the industry-average benchmark EPD.
- The life cycle stages considered shall be consistent between the manufacturer-specific EPD and the industry-average benchmark EPD. If the scope of the PCR allows for optional reporting of modules not included in the industry-average EPD, they may not be included for benchmarking purposes.
- Manufacturer-specific use phase calculations in the Project Report shall be consistently applied between the manufacturer-specific EPD and the industry-average benchmark EPD as outlined in the sub-category Part B PCR.
- End of life assumptions in module C shall be consistently applied as specified in the core and sub-category Part B PCR between the manufacturer-specific EPD and the industry-average benchmark EPD.
- Cut-off criteria for inclusion of mass and energy flows shall be consistently applied as specified in this Part A PCR between the manufacturer-specific EPD and the industry-average benchmark EPD.

- A comparison with the values reported in the Best Available Technology (BAT) document (gate-to-gate) and other available data sources (cradle-to-gate data from commercial databases and confidential sources) should be done as well as plausibility checks.
- When claiming impact reductions for green building schemes, results are significant as defined by at least a 5% or greater reduction in any given impact category with the exception of Ozone Depletion Potential (ODP). In the case of ODP, a 10% or greater reduction in impact qualifies as significant.

9.3 MANUFACTURER SPECIFIC BENCHMARKING

When a manufacturer-specific EPD is benchmarked against an existing manufacturer-specific EPD from the same manufacturer, the following requirements shall be met in addition to the comparability requirements listed in ISO 21930, Section 5.5.:

- The life cycle stages considered for benchmarking in each EPD shall be consistent.
- Data sources shall be consistent as it pertains to:
    - Priority of primary and secondary data sources
    - Application of background LCI data sets and version. If LCI dataset method updates occur between the publication of the benchmark EPD and updated EPD, the benchmark EPD results shall be recalculated using the most recent LCI datasets and used for benchmarking with the updated EPD.
    - Application of specific secondary, non-LCI data.
- LCA modelling software and version used shall be consistent. If LCA software updates occur between the publication of the benchmark EPD and updated EPD, the benchmark EPD results shall be recalculated using the most recent software version and used for benchmarking with the updated EPD.
- Cut-off criteria for inclusion of mass and energy flows shall be consistently applied.
- Product specific use phase calculations in the Project Report shall be consistently applied as outlined in this Part A PCR or the sub-category Part B PCR
- End of life assumptions in Module C shall be consistently applied as specified in this Part A PCR or sub-category Part B PCR
- Providing they do not conflict with existing confidentiality agreements, sources of deviation from the benchmark EPD shall be documented and quantified, including but not limited to:
    - Number of manufacturing locations considered
    - Sourcing changes
    - Product design changes implemented
    - Process changes implemented
    - Processing waste treatment changes
    - End of life pathway changes
- When claiming impact reductions for green building schemes, results are significant as defined by at least a 5% or greater reduction in any given impact category with the exception of Ozone Depletion Potential (ODP). In the case of ODP, a 10% or greater reduction in impact qualifies as significant.

EXAMPLE: In 2018, the company estimates a 10% improvement in climate change from 2014. To ensure comparability, the 2014 benchmark EPD results shall be recalculated using the most recent LCA software version and used for benchmarking with the 2018 updated EPD.

10 REFERENCES

ISO 14044	ISO 14044:2006/Amd 1:2017, Environmental Management — Life Cycle Assessment — Requirements and Instructions.
ISO 21930	ISO 21930:2017, Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services.
EN 15804	EN 15804 + A1:2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.
CEN/TR 15941	CEN/TR 15941:2010-03: Sustainability of construction works — Environmental Product Declarations — Methodology for selection and use of generic data.
IPCC	2014. Climate Change 2013. The Physical Science Basis. Cambridge University Press. http://www.ipcc.ch/report/ar5/wg1/
Heijungs et al.	Heijungs R., Guinée J.B., Huppes G., Lankreijer R.M., Udo de Haes H.A., Wegener Sleeswijk A. Environmental Life Cycle Assessment of Products: Guide and Backgrounds. CML. Leiden University, Leiden, 1992
Hauschild & Wenzel	Hauschild M.Z., & Wenzel H. Environmental Assessment of Products. Springer, US, Vol. 2, 1998
USGBC	PCR Committee Process & Resources: Part B. 2017.
WMO	WMO. 1999. Scientific Assessment of Ozone Depletion: 1998, World Meteorological Organization Global Ozone Research and Monitoring Project – Report No. 44, WMO, Geneva
Jenkin & Hayman	Jenkin M.E. & Hayman G.D. Photochemical ozone creation potentials for oxygenated volatile organic compounds: sensitivity to variations in kinetic and mechanistic parameters. Atmospheric Environment. 1999, 33 (8) pp. 1275–1293

11 MODIFICATIONS FOR NORTH AMERICAN HARMONIZATION AND REGIONALIZATION

For a complete list of modifications since its original publication, please refer to version 3.0 of this document.