PRODUCT CATEGORY RULES (PCR)
DATE 2023-10-06

ROLLING STOCK AND PARTS THEREOF

PRODUCT CATEGORY CLASSIFICATION: UN CPC 495

PCR 2009:05
Version 4.0.2

Valid until: 2027-07-06

TABLE OF CONTENTS

1 INTRODUCTION

This document constitutes Product Category Rules (PCR) developed in the framework of the International EPD® System: a programme for type III environmental declarations[1] according to ISO 14025:2006, ISO 14040:2006, ISO 14044:2006. Environmental Product Declarations (EPD) are voluntary documents for a company or organisation to present transparent consistent and verifiable information about the environmental performance of their products (goods or services).

The rules for the overall administration and operation of the programme are the General Programme Instructions (GPI), publicly available at www.environdec.com. A PCR complements the GPI and the normative standards by providing specific rules, requirements and guidelines for developing an EPD for one or more specific product categories (see Figure 1). A PCR should enable different practitioners using the PCR to generate consistent results when assessing products of the same product category.

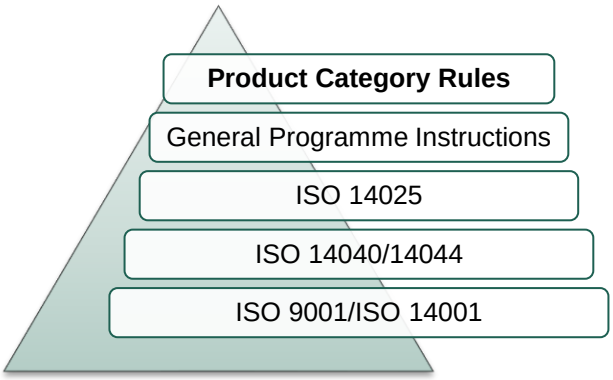

Figure 1 The hierarchy between PCRs, standards and other documents.

Within the present PCR, the following terminology is adopted:

- The term “shall” is used to indicate what is obligatory.
- The term “should” is used to indicate a recommendation, rather than a requirement. Any deviation from a “should” requirement shall be justified in the PCR development process.
- The term “may” or “can” is used to indicate an option that is permissible

For the definition of terms used in the document, see the normative standards.

A PCR is valid for a pre-determined period of time to ensure that it is updated at regular intervals. The latest version of the PCR is available via www.environdec.com. Stakeholder feedback on PCRs is very much encouraged. Any comments on this PCR may be sent directly to the PCR Moderator and/or the Secretariat during its development or during its period of validity.

Any references to this document should include the PCR registration number, name and version.

The programme operator maintains the copyright of the document to ensure that it is possible to publish, update, and available to all organisations to develop and register EPDs. Stakeholders participating in PCR development should be acknowledged in the final document and on the website.

[1] Type III environmental declarations in the International EPD® System are referred to as EPD, Environmental Product Declarations.

2 GENERAL INFORMATION

2.1 ADMINISTRATIVE INFORMATION

Name:	Rolling stock and parts thereof
Registration number and version:	2009:05, version 4.0.2
Programme:	The International EPD® System
Programme operator:	EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. Website: www.environdec.com E-mail: info@environdec.com
PCR Moderator:	Ulrika Överstam, Alstom, Ulrika.overstam@alstomgroup.com
PCR Committee:	UNIFE Sustainable Transport Committee, Alstom, CAF, Siemens, Talgo, Hitachi Rail, Knorr-Bremse, Saft Batteries, Voestalpine
Date of publication and last revision:	2023-10-06 (Version 4.0.2). A version history is available in Section 8.
Valid until:	2027-07-06
Schedule for renewal:	A PCR is valid for a pre-determined period of time to ensure that it is updated at regular intervals. When the PCR is about to expire the PCR moderator shall initiate a discussion with the Secretariat how to proceed with updating the document and renewing its validity. A PCR document may be revised during its period of validity provided significant and well-justified proposals for changes or amendments are presented. See www.environdec.com for up-to-date information and the latest version. When there has been an update of the PCR, the new version should be used to develop EPDs. The old version may however be used for 90 days after the publication date of the new version, as long as the old version has not expired.
Standards conformance:	General Programme Instructions of the International EPD® System, version 4.0, based on ISO 14025 and ISO 14040/14044
PCR language(s):	This PCR was developed and is available in English. In case of translated versions the English version takes precedence in case of any discrepancies.

2.2 SCOPE OF PCR

2.2.1 PRODUCT CATEGORY DEFINITION AND DESCRIPTION

This document provides Product Category Rules (PCR) for the assessment of the environmental performance of Rolling stock and the declaration of this performance by an EPD. The product category corresponds to UN CPC 495 Rolling stock.

This PCR is applicable for all rolling stock and refers to all types of rolling stock, e.g. locomotives, passenger carriages, goods wagons. Based on the service two major types of rolling stock can be distinguished: Passenger and Freight, see Table 1. In addition, this PCR can be used to cover a reduced scope of a rolling stock such as a product group (PG) or a sub-product group (SPG) as defined in section 2.2.2 if there is no specific PCR for the PG or the SPG.

	CHARACTERISTICS	UTILIZED VEHICLES
Passenger service types		
Urban	- Inner city - Very short distance between stations - High passenger capacity	- Totally low or partially low floor tramways - Light rail vehicles - Heavy rail vehicles - Metros - People Movers
Suburban	- Mainline service - Short distance between stations - High train frequency - High passenger capacity - Short term on-board time	- Heavy rail vehicles - Single- and double-deck electric/battery/H2 multiple units - Hybrid vehicles such as tram-trains
Regional	- Mainline service - Medium to long distance between stations - Average train frequency - Average number of passengers	- Single- and double-deck electric/battery/H2 multiple units - Electric/battery/diesel/H2 locomotives with single- and double-deck passenger coaches - Diesel/H2 multiple units for non-electrified lines - Coaches
Intercity	- Mainline service - Medium to long distance between stations - Direct city-to-city connections	- Single- and double-deck electric/battery/H2 multiple units - Electric/battery/diesel/H2 locomotives with single- and double-deck passenger coaches - High performance diesel/H2 multiple units for non-electrified lines - Coaches
High / Very high speed	- Mainline service - Medium to long distance between stations - Direct main city connections	- Single- and double-deck electric/battery/H2 multiple units, specialized for high speed service
Freight service types		
Mainline	- Mainline service - Long distance between stops	- Electric/battery/diesel/H2 locomotives and goods wagons in different typologies depending on the cargo

Table 1 Rolling stock service types.

2.2.2 PRODUCT GROUPS

For the rolling stock covered by this PCR, five main product groups have been distinguished.

These five product groups can be used for all possible variants of rolling stock applications and include various main product groups (MPG) as well as sub product groups (SPG) as defined in the EN 15380-2 standard. The designation system of the product group structure can be seen in Table 2.

PRODUCT GROUP	MPG	SPG
1. Car body	**B**	body (A), underframe (B), side walls (C), roof (D), head of vehicle (E), end walls (F), weld-on/add-on parts (G), intermediate floor (H), partitions (J)
	S	vehicle linkage devices (A), automatic coupling devices (B), manual coupling devices (C), buffing gear (D), Towing gear: emergency couplings (E), gangway (F), vehicle-vehicle interface for media + signal + power (G)
2. Interior, windows and doors	C	vehicle fitting out (A), windows (B), floor (C), interior panelling (D), partitions (E), external additions (F), vehicle paintwork (G), insulation (H)
	D	interior appointments (A), inside rails and handles (B), seats + sleeping berths + tables (C), sanitary facilities (D), luggage racks (E), additional devices (F)
	N	doors and entrances (A), external doors (B), internal doors (C), not inside entrances + steps (D), entrances for the disabled (E)
3. Bogies and running gears	E	running gear (A), supporting structures (B), wheel sets (C), suspension + damping + balancing gear (D), active driving system (E), passive driven system (F), safety add-ons (G)
	R	brake (A), brake components (B), mechanical brake force transmission (C)
	Q	pneumatic and hydraulic equipment (A), generation (B), treatment (C), storage (D), distribution (E)
	M	ancillary operating equipment (A), sanding equipment (B) lubricating equipment (C), points operating equipment (D), ticket machines (E), passenger counting device (F)
4. Propulsion and electric equipment	F	power system and drive unit (A), power supply (B), power generation (C), power conversion (D), power dissipation (E), power storage (F)
	G	control apparatus for train operations (A), power supply controls (B), driving and brake controls (C), power generation controls (D), system data acquisition (E), power storage controls (F)
	H	ancillary operating equipment (A), converter equipment (B), battery device (C), on-board supply system (D), cooling unit for power and drive systems (E), emergency power generators (F)
	J	monitoring and safety device (A), measuring and protective devices (B), indicating + recording + display devices (C), safety equipment (D), data transmission devices (E), communication equipment (F), miscellaneous equipment (G)
	K	lighting (A), exterior lighting equipment (B), interior lighting equipment (C)
	P	information facilities (A), visual information facilities (B), visual information elements (C), entertainment (D), advertising (E), audible information facilities (F)
	T	carrier system + enclosures (A), cabinets + boxes + containers (B), frames + boards (C), control and display units (D), electronic rack systems (E)
	U	electrical wiring (A), cables + conductors + bars (B), marking and connection materials (C), connecting material (D), bushings (E), cable ducts + pipes + flexible tubes (F)
5. Comfort systems	L	air conditioning (A), intake/evacuation of air (B), treatment (C), distribution (D), regulation (E)

Table 2 Detailed description of the included product groups (EN 15380-2), including product prefix sign and code letters for MPG and SPG . A system can be described by combining the PG prefix sign number, the MPG code letter and the SPG code letter, ie for the battery device 4HC. (PG = Product group, MPG = Main product group, SPG = Sub product group.)

2.2.3 GEOGRAPHICAL REGION

This PCR is applicable globally.

2.2.4 EPD VALIDITY

An EPD based on this PCR shall be valid for a 5-year period starting from the date of the verification report (“approval date”), or until the EPD has been de-registered from the International EPD® System.

An EPD shall be updated and re-verified during its validity if changes in technology or other circumstances have led to:

- an increase of 10% or more of any of the declared indicators of environmental impact,
- errors in the declared information, or
- significant changes to the declared product information, content declaration, or additional environmental information.

If such changes have occurred, but the EPD is not updated, the EPD owner shall contact the Secretariat to de-register the EPD.

3 PCR REVIEW AND BACKGROUND INFORMATION

This PCR was developed in accordance with the process described in the General Programme Instructions of the International EPD® System, including PCR review and open consultation.

3.1 OPEN CONSULTATION

3.1.1 VERSION 1.0, 2.X

Version 1.0, 2.0 and 2.1 of this PCR was available for open consultation on www.environdec.com.

3.1.2 VERSION 3.0

This PCR was available for open consultation from 2018-09-07 until 2018-11-07, during which any stakeholder was able to provide comments by posting on the PCR forum on www.environdec.com or by contacting the PCR moderator.

Stakeholders were invited via e-mail or other means to take part in the open consultation, and were encouraged to forward the invitation to other relevant stakeholders. The following stakeholders provided comments during the open consultation, and agreed to be listed as contributors to the PCR and at www.environdec.com:

- Rob Rouwette, start2see
- Gorka Benito, IK INGENIERIA

3.1.3 VERSION 4.0.0

This PCR was available for open consultation from 2022-12-05 until 2023-02-26, during which any stakeholder was able to provide comments by contacting the PCR Moderator and/or the Secretariat.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders. The following stakeholder provided comments during the open consultation, and agreed to be listed as contributor to the PCR and at www.environdec.com:

- Eva Martínez Herrero, Fundación Centro Tecnológico de Miranda de Ebro (CTME)

3.2 PCR REVIEW

3.2.1 VERSION 1.0 AND 2.0

Version 1.0 and 2.0 were reviewed by the Technical Committee of the International EPD® System.

3.2.2 VERSION 3.0

PCR review panel:	The Technical Committee of the International EPD® System. A full list of members available on www.environdec.com. The review panel may be contacted via info@environdec.com. Members of the Technical Committee were requested to state any potential conflict of interest with the PCR moderator or PCR committee, and were excused from the review.
Chair of the PCR review:	Adriana Del Borghi
Review dates:	2018-11-27 until 2018-12-20

3.2.3 VERSION 4.0.0

PCR review panel:	The Technical Committee of the International EPD® System. A full list of members is available at www.environdec.com. The review panel may be contacted via info@environdec.com. Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review.
Chair of the PCR review:	Claudia A. Peña
Review dates:	2023-03-28 until 2023-05-22

3.3 EXISTING PCRS FOR THE PRODUCT CATEGORY

As part of the development of this PCR, existing PCRs and other internationally standardized methods that could potentially act as PCRs related to rolling stock (i.e. vehicles) were considered in order to avoid overlaps in scope and to ensure harmonisation with established methods of relevance for the product category. The existence of such documents was checked among following EPD programmes and international standardisation bodies:

- International EPD® System www.environdec.com.

3.4 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed in order to enable publication of Environmental Product Declarations (EPD) for this product category based on ISO 14025, ISO 14040/14044 and other relevant standards to be used in different applications and target audiences. The PCR enables different practitioners to generate consistent results when assessing the environmental impact of products of the same product category, and thereby it supports comparability of products within a product category.

The development of this Product Category Rules (PCR) document was initiated by UNIFE in June 2008 and the preparation of the document has been led by the Sustainable Transport Committee (STC) at UNIFE. Representatives of the different parts of the rail transport sector, system integrators, rolling stock manufacturers, sub-system suppliers and operators have been involved in the development process. The main companies involved were; Alstom, Bombardier Transportation, Siemens, Knorr-Bremse and Saft Batteries.

The work to develop this PCR was prepared and discussed at several meetings as well as telephone conferences. The initial work was started in June 2008 and finalized in October 2009 and subsequently revised according to decisions made. An update of the PCR was conducted during 2011 and 2012; the work was conducted in the same manner as when it was prepared. In addition to the UNIFE parties involved in the preparation of the first release, CAF and Talgo participated in the update. During 2017 and 2018 a review of the PCR was conducted, this was done within the work of the UNIFE topic group for LCA. The review in 2022 was done within the UNIFE topic group for LCA, the result is this document. Company members to the UNIFE topic group for LCA involved in this PCR update see the PCR committee see section 2.1.

3.5 UNDERLYING STUDIES

The methodological choices made during the development of this PCR (functional unit/declared unit, system boundary, allocation methods, impact categories, data quality rules, etc.) were based on several studies produced during the 1990s and 2000s. The continued development of this PCR has since followed the development of LCA methodologies and also software development. Several published EPDs based on older versions of PCR 2009:05 are available on www.environdec.com.

4 GOAL AND SCOPE, LIFE CYCLE INVENTORY AND LIFE CYCLE IMPACT ASSESSMENT

The goal of this section is to provide specific rules, requirements and guidelines for developing an EPD for the product category as defined in Section 2.2.1 and 2.2.2.

4.1 FUNCTIONAL UNIT/DECLARED UNIT

The functional units for the different types of rolling stock (see Section 2.2 for definition of rolling stock) shall be used to normalize the considered inputs, outputs and environmental impacts of the studied product.

For EPDs not covering a full life cycle, e.g. product for which the use phase is unknown or the function of the product/-s in terms of use are unknown or partially known and/or covering a product group or sub-product, the concept of functional unit is transferred into a declared unit.

4.1.1 FUNCTIONAL UNIT - PASSENGER ROLLING STOCK

The functional unit chosen to quantify the main function is **transport of 1 passenger for 1 km**. The main function of a passenger rolling stock is the transportation of a given number of passengers over a predefined distance. Additional information detailing the type of service, country of operation etc may be included in the functional unit to further define it in the EPD.

The total number of passengers shall be calculated for the rolling stock in its configuration and use case. The definition of vehicle reference masses shall be supported by the standard EN 15663, deviations shall be declared in the LCA report.

4.1.2 FUNCTIONAL UNIT - FREIGHT ROLLING STOCK

The functional unit chosen to quantify the main function is **the transport of 1 tonne[2] of cargo for 1 km**. The main function of a rolling stock for freight transportation is the transportation of a given amount of goods over a predefined distance.

The total weight taken into consideration in the calculation shall include the weight of the locomotive, all rail-cars, and the weight of the cargo.

4.1.3 DECLARED UNIT

A declared unit is recommended if the LCA does not cover a full rolling stock but only a product group or a sub-product group.

Although a declared unit is defined as a quantity of the product rather than its quantified performance, the definition of declared unit shall be relevant in relation to the typical applications the product. Examples of these are:

- an item, an assemblage of items, e.g. 1 seat, 1 window (dimensions shall be specified), 1 HVAC unit
- mass (kg), e.g. 1 kg of
- area (m^2), e.g. 1 square metre of wall elements, 1 square metre of insulation panel (dimensions shall be specified)

The functional unit is mandatory if the scope of the EPD is a complete rolling stock.

The declared unit shall be stated in the EPD. The environmental impact shall be given per declared unit. A description of the function of the product shall be included in the EPD.

[2] 1 tonne = 1000 kg

4.2 TECHNICAL SPECIFICATION, LIFESPAN AND REFERENCE SERVICE LIFE (RSL)

In the EPD the lifespan of the rolling stock shall be stated as part of the scope of the EPD. Reference service life is not applicable for this product category as the expected service life (lifespan of a rolling stock) depends on the scope of the EPD and varies depending on service type.

4.3 SYSTEM BOUNDARY

The International EPD® System uses an approach where all attributional processes from “cradle to grave” should be included using the principle of “limited loss of information at the final product”. This is especially important in the case of business-to-consumer communication.

The scope of this PCR and EPDs based on it is covering the life cycle of the rolling stock, product group or a sub-product group as consisting of three major modules: upstream, core and downstream, an overview of which is shown in Figure 2. The environmental performance of the rolling stock shall be reported separately for each module. The LCA calculations shall include all upstream, core and downstream processes as described in Section 4.3.1.

4.3.1 LIFE CYCLE STAGES

For the purpose of different data quality rules and for the presentation of results, the life cycle of products is divided into three different life cycle stages:

- Upstream processes (from cradle-to-gate)
- Core processes (from gate-to-gate)
- Downstream processes (from gate-to-grave)

In the EPD, the environmental performance associated with each of the three life-cycle stages above shall be reported separately, and in aggregated form. The processes included in the scope of the PCR and belonging to each life cycle stage are described in Sections 4.3.1.1–4.3.1.3.

4.3.1.1. Upstream processes

The following unit processes are part of the product system and classified as upstream processes:

- Extraction and production of raw and basic materials – e.g. aluminium, stainless steel, polyethylene, etc. for all main parts and components.
    - This shall include all the associated processes like mining, transportation, used electricity, heat, steam and fuel. The waste generated from the included processes and its treatment shall also be included. All this information is often incorporated in LCI data from databases when a cradle-to-gate process/dataset for a material is selected, e.g. steel.
- Production of auxiliary materials (e.g. consumables like welding wire, washing agent) for rail vehicle assembly/manufacturing
- Transportation from tier 1 (direct) suppliers to the rolling stock assembly/manufacturing facility.

A minimum of 95% of the total weight of the declared product shall be included if compliant with the cut off criteria on elementary flows in Section 4.5.

The following upstream processes shall be excluded:

- Building, maintenance, dismantling and disposal of material and energy production plants
- Building, maintenance, dismantling and disposal of suppliers’ manufacturing facilities
- Transportation of raw and basic materials to suppliers’ manufacturing with the exception processes in selected data sets
- Manufacturing processes of components by suppliers with the exception of production processes in selected data sets (e.g. button cell battery).
- Production of packaging

Upstream processes not listed may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

4.3.1.2. Core processes

The following unit processes are part of the product system and classified as core processes:

- Production and use of resources (e.g. electricity, heat, and steam fuel etc.) associated with the vehicle assembly.
- Production and use of known auxiliary materials (e.g. consumables like welding wire, washing agent, mounting equipment, etc. which are not included in upstream module) used for the vehicle assembly.
- Internal transportation between sites involved in the core process
- Transportation of the rail vehicle from the assembly facility to the location of its use (to the customer)
- Waste generated and treatment of waste from the assembly processes on the Rolling Stock manufacturer site

A minimum of 95% of the total weight of the declared product shall be included if compliant with the cut off criteria on elementary flows in Section 4.5. Manufacturing processes not listed may also be included.

The following core processes shall be excluded:

- Building, maintenance, dismantling and disposal of rail vehicle assembly/manufacturing facilities
- Packaging of rail vehicle
- Business travel of personnel.
- Travel to and from work by personnel.
- Research and development activities.
- Waste generated and treatment of waste from suppliers packaging on the Rolling Stock manufacturer site
- Transportation of auxiliary materials to assembly plant
- Validation/testing of the rolling stock is to be an excluded process, unless the resources used for the testing/validation cannot fully or partly be separated from core process data.

If waste from supplier packaging can't be separated from other waste from the assembly/manufacturing site the waste generated form supplier packaging can be included in the LCA if not adding significant to the result of the EPD.

4.3.1.3. Downstream processes

The information for the downstream module shall be presented separately for the use phase and end-of life phase, to get a better transparency of the result.

The following unit processes are part of the product system and classified as downstream processes and shall be included:

- Production and consumption of electricity and/or fuel for rail vehicle operation (well to wheel)
- Production and transport of materials used to operate the vehicle, e.g. brake pads and flange lubrication
- Production and transport of maintenance materials and spare parts (based on the rail vehicle preventive maintenance program)
- Waste from maintenance materials and spare parts (based on the rail vehicle preventive maintenance program)
- Transport of vehicle and spare part to disposal site
- Direct disposal of materials or incineration of residues
- Incineration of materials (energy recovery is attributed to the next life cycle and credits from energy recovery shall not be included)

The following processes shall be excluded:

- Building, maintenance, dismantling and disposal of rail vehicle disassembly and waste treatment facilities (for more information see Section 4.3.2)

- Building, maintenance, dismantling and disposal of railway infrastructure and service facilities (for more information see Section 4.3.2)
- Cleaning of the rail vehicle during rail vehicle operation including all cleaning activities and production and use of cleaning agents, etc.
- Treatment and disposal of waste generated from passengers during rail vehicle operation
- Material recycling at end of life, see Section 4.6.2
- Re-use of rail vehicle components and spare parts

4.3.2 INFRASTRUCTURE AND CAPITAL GOODS

In general, the production and end-of-life processes of infrastructure or capital goods[3] used in the product system should not be included within the system boundaries. They may be included when infrastructure and capital goods are known to be relevant in terms of their environmental impact, or when a generic LCI dataset includes infrastructure/capital goods, and it is not possible, within reasonable effort, to subtract the data on infrastructure/capital goods from this dataset. If an infrastructure/capital good is produced with the intention to be used one or a few times only (e.g., a manufacturing plant or machinery constructed to produce only one product), this infrastructure/capital good shall be included.

The inclusion or exclusion of infrastructure/capital goods shall be transparently described for upstream, core and downstream processes in the LCA report and in the EPD.

If infrastructure/capital goods are included, the following disclaimer shall be included in the results sections of the LCA report and in the EPD (land use and toxicity indicators shall only be mentioned if declared in the EPD):

The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity, non-cancer and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets, in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.

4.3.3 OTHER BOUNDARY SETTING

4.3.3.1. Boundary in time

The temporal boundary defines the time period for which the life cycle inventory data is recorded, e.g. for how long emissions from waste deposits are accounted. As default, the time period over which inputs to and outputs from the product system is accounted for shall be 100 years from the year that the LCA model best represents, considering the representativeness of the inventory data. This year shall, as far as possible, represent the year of the publication of the EPD.

4.3.3.2. Boundary towards nature

Boundaries to nature are defined as flows of material and energy resources from nature into the system. Emissions to air, water and soil cross the system boundary when they are emitted from or leaving the product system.

4.3.3.3. Boundary towards geography

LCI data describing the energy and material inputs and outputs shall be representative for the country or the region in which the processes are taking place. In rare cases when no other information is available global data, e.g. world average values may be used.

[3] Examples of infrastructure and capital goods are the building in which the studied product or upstream materials or components are produced, machinery used in the manufacturing of the product or its materials or components, or vehicles used in transports in the product system. For example, if the EPD is on wind power, the power plant itself is considered the studied product and not infrastructure/capital goods. However, the buildings and machinery that make the wind turbine components are considered infrastructure/capital goods. Similarly, if the EPD is on a means of transport, the vehicle is considered the studied product and not infrastructure/capital goods.

The geographically boundary for the EPD is decided by the geographical scope of the use case and can differ from the geographical scope of the LCI data.

4.3.3.4. Boundaries in the life cycle

See Section 4.3.1. the EPD may present the information divided into additional sub-divisions.

4.3.3.5. Boundaries towards other technical systems

Boundaries towards other technical systems define the flow of materials and components to/from the product system under study and from/to other product systems. If there is an inflow of recycled material to the product system in the production/manufacturing stage, the transport from the scrapyard/collection site to the recycling plant, the recycling process, and the transportation from the recycling plant to the site where the material is being used shall be included. If there is an outflow of material or component to recycling, the transportation of the material to the scrapyard/collection site shall be included. The material or component going to recycling is then an outflow from the product system.

See Section 4.6 for more details.

4.4 SYSTEM DIAGRAM

Upstream, core and downstream processes within the system boundaries are the ones related only with the production, operation and disposal of the rolling stock. Those processes are shown in the coloured circle Figure 2. Facilities and infrastructure that are not part of the subject of the study itself are out of the system boundaries (i.e. facilities for energy and material production, roads and infrastructure for transport, manufacturing plants, rail infrastructure and dismantling process and disposal facilities) (see Section 4.3.2). Those processes are shown in grey (to the right) in Figure 2. Exclusion of any process within the system boundary, as described in Section 4.3.1, shall in general be avoided and if necessary shall be justified and reported in the EPD.

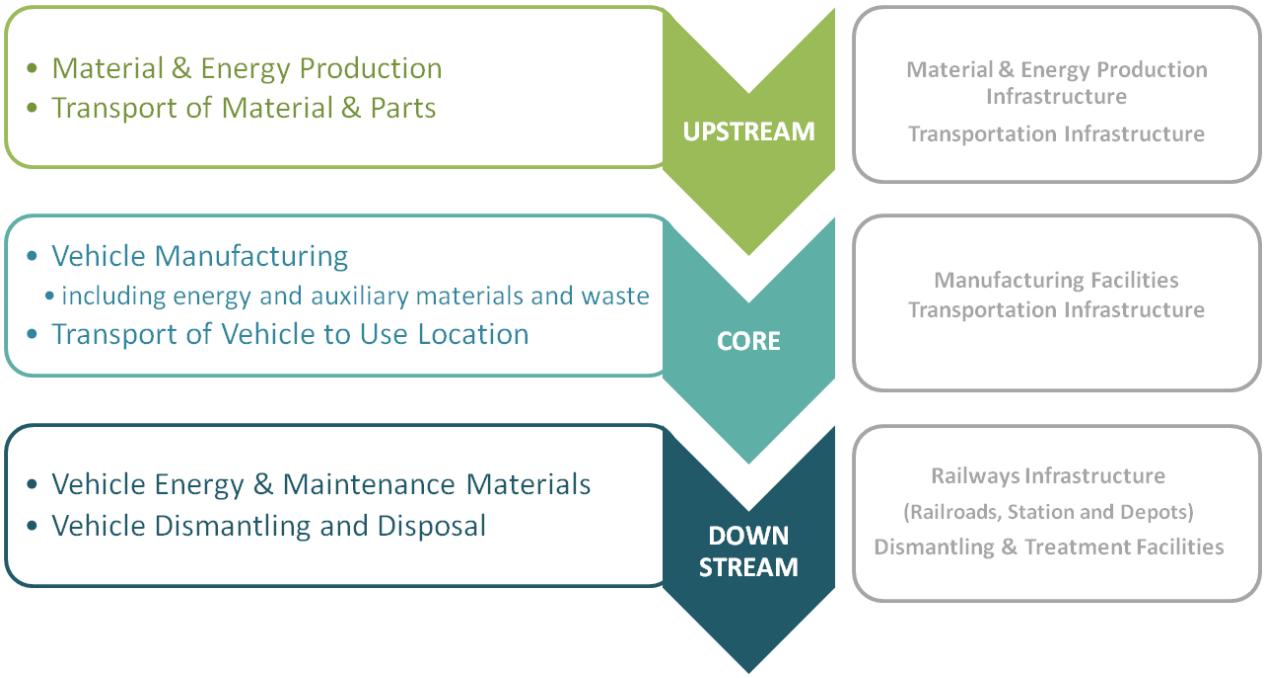

Figure 2 Rolling Stock System Boundaries.

4.5 CUT-OFF RULES

A cut-off rule of 1% shall be applied. In other words, the included inventory data (not including inventory data of processes that are explicitly outside the system boundary as described in Section 4.3) shall together give rise to at least 99% of the results of any of the

environmental impact categories. The cut-off of inventory data should, however, be avoided, and all available inventory data shall be used.

Activities and materials not included in the LCA shall be documented and justified in the LCA report.

This criterion does not apply for substances included in the Railway Industry Substance List (http://www.unife-database.org/download.php) which shall be included in the LCA as far as possible.

If certain data is unavailable a sensitivity check based on a set case scenario shall be applied in order to include all significant environmental impacts. The set case scenario to be used is outlined below:

- Any missing material production shall be represented by “Aluminium production or a similar process including cradle to gate process from virgin material to pure metal”
- Any missing transport shall be represented by “500 km of road transport with truck”

No action is needed if these processes do not contribute more than 1% to each of the considered impact categories of the final result. If, however, they contribute more than 1% additional effort needs to be applied in trying to find more information for a specific process to see if a more accurate figure can be obtained.

The cut-off of inventory data, based on the above cut-off rule, should be an output of a sensitivity analysis, alone or in combination with expert judgment based on experience of similar product systems. Further, the cut-off shall be possible to verify in the verification process, hence the exclusion of inventory data based on the cut-off rule shall be documented in the LCA report, and the EPD developer shall provide the information the verifier considers necessary to verify the cut-off.

4.6 ALLOCATION RULES

Allocation can be divided into allocation of co-products, i.e. allocation of unit processes that generate several products, and allocation of waste, i.e. allocation of unit processes that generate materials that are, for example, landfilled recovered, recycled or reused, and which require further processing to cease being waste and become products (see criteria for end-of-waste state in Section 4.6.2).

The principles for allocation of co-products and allocation of waste are described separately in the following subsections.

4.6.1 CO-PRODUCT ALLOCATION

The following step-wise procedure shall be applied for multifunctional products and multiproduct processes:

1. Allocation shall be avoided, if possible, by dividing the unit process into two or more sub-processes and collecting the environmental data related to these sub-processes.
2. If allocation cannot be avoided, the inputs and outputs of the system shall be partitioned between its different products or functions in a way that reflects the underlying physical relationships between them; i.e. they should reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system.
3. If a physical relationship between the inventory data and the delivery of co-products cannot be established, the inventory data should be allocated between the co-products in a way that reflects other relationships between them. For example, inventory data might be allocated between co-products in proportion to man hours or their economic values. If economic allocation is used, a sensitivity analysis exploring the influence of the choice of the economic value shall be included in the LCA report.

Any allocation shall be justified and the procedure described in the LCA report.

4.6.2 ALLOCATION OF WASTE TREATMENT PROCESSES

Allocation of waste shall follow the polluter pays principle and means that the generator of the waste shall carry the full environmental impact until the point in the product´s life cycle at which the waste is transported to a scrapyard or the gate of a waste processing plant (collection site). The end-of-waste state is reached when all the following criteria for the end-of-waste state are fulfilled:

- the recovered material, component or product is commonly used for specific purposes;
- a market or demand, identified e.g. by a positive economic value, exists for such a recovered material, component or product;
- the recovered material, component or product fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and

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

The above outlined principle means that the generator of the waste shall carry the full environmental impact until the point in the product life cycle in which the end-of-waste criteria are fulfilled. Waste may have a negative economic market value, and then the end-of-waste stage is typically reached after (part of) the waste processing and further refinement, at the point at which the waste no longer has a negative market value. This allocation method is (in most cases) in line with a waste generator's juridical and financial responsibilities. See the GPI for further information and examples.

4.7 DATA QUALITY REQUIREMENTS

Life cycle inventory data are classified into specific data and generic data, where the latter can be selected generic data or proxy data. The data categories are defined as follows:

- specific data (also referred to as "primary data" or "site-specific data"):
  - data gathered from the actual manufacturing plant where product-specific processes are carried out;
  - actual data from other parts of the life cycle traced to the product under study, for example site-specific data on the production of materials or generation of electricity provided by contracted suppliers, and transportation data on distances, means of transportation, load factor, fuel consumption, etc., of contracted transportation providers; and
  - LCI data from databases on transportation and energy ware that is combined with actual transportation and energy parameters as listed above.
- generic data (sometimes referred to as "secondary data"), divided into:
  - selected generic data: data (e.g. commercial databases and free databases) that fulfil prescribed data quality requirements for precision, completeness, and representativeness (see below Section 4.7.1),
  - proxy data: data (e.g. commercial databases and free databases) that do not fulfil all of the data quality requirements of "selected generic data".

Specific data shall be used for the core processes. Specific data shall be used for upstream and downstream processes, when available, otherwise generic data may be used. Generic data should be used in cases in which they are representative for the purpose of the EPD, e.g. for bulk and raw materials on a spot market, if there is a lack of specific data on the final product or if a product consists of many components.

4.7.1 RULES FOR USING GENERIC DATA

For generic data to be classified as "selected generic data", the following requirements apply:

- datasets shall be based on attributional LCA modelling (e.g., not be based on marginal data and not include credits from system expansion),
- the reference year shall be as current as possible and should be representative for the validity period of the EPD, the 1% cut-off rule (as described in Section A.3.3 of the GPI ver. 4.0) shall be met on the level of the product system,
- datasets shall represent average values for a specific reference year; however, how data are generated could vary, e.g. over time, and then they should have the form of a representative annual average value for a specified reference period (such deviations shall be justified and declared in the EPD), and
- data shall be representative for the given temporal, technological and geographical context as far as possible.

If selected generic data that meets the above data quality requirements are not available, proxy data may be used. The environmental impacts associated with proxy data shall not exceed 10% of the overall environmental impact of the product system.

The EPD may include a data quality declaration to demonstrate the share of specific data, selected generic data and proxy data contributing to the results of the environmental impact indicators.

4.7.2 RECOMMENDED DATABASES FOR GENERIC DATA

Table 3 lists recommended databases for generic data. Please note that this listing does not imply that other data sets that fulfil the data quality requirements may not be used if they fulfil the data quality requirements. For all data sets used in the study, if originating for listed sources or not, a data quality assessment shall be performed by the LCA practitioner.

PROCESS	DATABASE
Steel, Primary copper, Copper products, Electricity, Fuels, Aluminium, Chemicals, Transports, Waste management,	- Sphera-LCA for Experts - ELCD - Ecoinvent - EIME
Plastics	- Plastics Europe (Association of Plastics Manufacturers in Europe) - Sphera-LCA for Experts - ELCD - Ecoinvent - EIME
Electronic components	- Sphera-LCA for Experts - ELCD - Ecoinvent - EIME

Table 3 Recommended databases for generic data.

If these data sources do not supply the necessary data, other generic data sources listed at the http://lct.jrc.ec.europa.eu may be used. It is recommended to consistently use one database for the entire LCA.

4.7.3 DATA QUALITY REQUIREMENTS AND OTHER MODELLING GUIDANCE PER LIFE CYCLE STAGE

Below are further data quality requirement per life-cycle stage. Exceptions to the requirements may be accepted, if justified in the EPD; such exceptions are subject to the approval by the verifier on a case-to-case basis.

4.7.3.1. Upstream processes

The following requirements apply to the upstream processes:

- The transportation from tier 1 (direct) suppliers to the rolling stock assembly/manufacturing facility is to be based on the actual transportation mode, distance from the supplier to the rolling stock assembly/manufacturing facility, and vehicle load.
- In case specific data is lacking, selected generic data may be used. If this is also lacking, proxy data may be used.
- For upstream processes modelled with specific data, generation of electricity used shall be accounted for in this priority:
    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market[4].
    4. Electricity consumption mix on the market[5].

[4] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

[5] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

"The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA .For upstream processes modelled with specific data the mix of electricity used in upstream processes shall be documented in the EPD, where relevant.

4.7.3.2. Core processes

The following requirements apply to the core processes:

- Specific data shall be used for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant. Life cycle inventory (LCI) data should be taken as 12 months averages and should be representative for the year/time frame for which the EPD is valid.
- For electricity used in the core processes, generation of electricity used shall be accounted for in this priority:
    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market[6].
    4. Electricity consumption mix on the market[7]. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control, as long as the composition of the residual grid mix has been publicly disclosed[8].

  The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

  "The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA.

  The mix of electricity used in the core processes shall be documented in the EPD, where relevant.
- The transport of the product to the customer shall be described in the LCA, which should reflect the actual situation to the best extent possible. The following priority should be used:
    1. Actual transportation distances and types.
    2. Calculated as the average distance of a product of that product type transported by different means of transport modes.
    3. Calculated as a fixed transport according to cut-off rules in section 4.5.
- Waste treatment processes of manufacturing waste should be based on specific data, if available.

4.7.3.3. Downstream processes

The following requirements apply to the downstream processes:

- Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant.

[6] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

[7] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

[8] If the composition of the residual grid mix has not been publicly disclosed, the second or third options in the above hierarchy are not feasible and thus the fourth option is the only remaining option (if the first option is not chosen).

- Data on the pollutant emissions from the use stage should be based on documented tests, verified studies in conjunction with average or typical product use, or recommendations concerning suitable product use. Whenever applicable, test methods shall be internationally recognised.
- For electricity used in the use stage, generation of electricity used shall be accounted for in this priority:
    1. Specific electricity mix as generated, or purchased, from an electricity supplier, demonstrated by a Guarantee of Origin (or similar, where reliability, traceability, and the avoidance of double-counting are ensured) as provided by the electricity supplier.
    2. Residual electricity mix on the market[9].
    3. Electricity consumption mix on the market[10].
- For end-of-life processes, the use of electricity in the region/country where the product is treated (as specified in the geographical scope of the EPD) should be accounted for in the following priority:
    1. Residual electricity mix on the market[11].
    2. Electricity consumption mix on the market[12].

  The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

  "The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA

  The mix of electricity used in the downstream processes shall be documented in the EPD including carbon dioxide intensity data (kg CO_2e/kWh), if publication of data not possible, data reference needs to be clear.
- Scenarios for the end-of-life stage shall be technically and economically practicable and compliant with current regulations in the relevant geographical region based on the geographical scope of the EPD. Key assumptions regarding the end-of-life stage scenario shall be documented.

For the downstream module the LCI data shall reflect the current time period of production based on realistic conditions related to the use phase and end-of-life scenarios.

4.7.3.3.1. Use phase scenario

Energy consumption can be acquired by simulation data calculation, real time measurements or standard duty cycles. The manner of data acquisition shall be specified in the EPD.

The criterion for the energy consumption of a rolling stock is the total net energy consumed at pantograph or from an onboard battery over a predefined operational profile, which is either taken from the future operation of the train, or according to a standardized profile valid for the specific category of rolling stock, which can be defined according to EN 50591.

The criterion for the diesel or H2 consumption of a rolling stock is the total amount of diesel or H2 consumed over a predefined operational profile, which is either taken from the future operation of the train, or according to a standardized profile valid for the specific category of rolling stock, which can be defined according to EN 50591.

The section on environmental performance results in the EPD shall only include one set of results (this change was implemented in version 4.0 of the GPI to improve machine-readability of EPDs and thereby facilitate digitalisation of the EPD system). If the EPD

[9] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

[10] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

[11] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

[12] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

owner wants to display results of several scenarios for the use phase, the most representative scenario (for the geographical scope of the EPD) shall be declared, and the other scenarios shall be declared in the section on additional environmental information.

4.7.3.3.2. End of Life Scenarios

The end-of-life modelling shall follow the ISO 21106, other methods like UNIFE Recyclability and Recoverability Calculation Method Railway Rolling Stock, UNI-LCA-001 may be used, however the EPD shall always present the recyclability and recoverability rate as per ISO 21106. The choice of calculation method shall be specified in the EPD.

4.8 ENVIRONMENTAL PERFORMACE INDICATORS

The EPD shall declare the default environmental performance indicators and their methods as described at the website (www.environdec.com/indicators), which includes both inventory indicators and indicators of potential environmental impact. The source and version of the impact assessment methods and characterisations factors used shall be reported in the EPD.

If the default list of environmental performance indicators and methods at www.environdec.com/indicators is updated, the previous version of the list is valid in parallel to the new version during a transition period of at least 90 days, as described at the website.

Apart from inventory indicators (such as the required and optional inventory indicators listed at www.environdec.com/indicators, other inventory data may also be declared in the EPD, if relevant and useful for EPD users. Such data shall not be declared in the main body of the EPD, but in an annex.

4.9 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

4.9.1 PRODUCTS FROM THE SAME COMPANY

Several sets of results, reflecting different products, are not allowed to be declared in the same EPD. However, similar products from a single or several manufacturing sites covered by the same PCR and manufactured by the same company with the same major steps in the core processes may be grouped and thereby included in the same EPD. For such an EPD, there are three options:

- For each indicator, declare the average results of the included products. This average shall be weighted according to the production volumes of the included products, if relevant. In this option, the average content shall be declared in the content declaration.
- Declare the results of one of the included products – a representative product. The choice of the representative product shall be justified in the EPD, using, where applicable, statistical parameters. For example, the choice may be based on production volumes. In this option, the content of the representative product shall be declared in the content declaration.
- For each indicator, declare the highest result of the included products (i.e., the results of a “worst-case product”, which may be the results of one or several of the included products). In this option, the content declaration shall include the lowest amounts of recycled and biogenic content of the included products and their packaging, respectively, and the information on environmental and hazardous properties of substances shall reflect the highest share and most hazardous such substances contained in any of the included products. For other parts of the content declaration, the average content or the interval of the content of all included products shall be declared.

The first two options are only possible if none of the declared environmental impact indicator results differ by more than 10% between any of the included products. The third option is possible also if variations are larger than 10%.

The option chosen shall be clearly described in the EPD.

4.9.2 SECTOR EPDS

The International EPD® System allows for an industry association to develop an EPD in the form of a Sector EPD. A Sector EPD declares the average product of multiple companies in a clearly defined sector in a clearly defined geographical area. Products covered in a sector EPD shall follow the same PCR and the same declared/functional unit shall be applied.

Any communication of the results from a Sector EPD should contain the information that the results are based on averages obtained from the sector as defined in the EPD. The communication shall not claim that the sector EPD results are representative for a certain manufacturer or its product.

The following information shall also be included a Sector EPD:

- a list of the contributing manufacturers that the Sector EPD covers,
- a description of how the selection of the sites/products has been done and how the average has been determined, and

a statement that the document covers average values for an entire or partial product category (specifying the percentage of representativeness) and, hence, the declared product is an average that is not available for purchase on the market.

5 CONTENT AND FORMAT OF EPD

EPDs based on this PCR shall contain the information described in this section. Flexibility is allowed in the formatting and layout provided that the EPD still includes the prescribed information. A generic template for EPDs is available at www.environdec.com

As a general rule the EPD content:

- shall be in line with the requirements and guidelines in ISO 14020 (Environmental labels and declarations - General principles),
- shall be verifiable, accurate, relevant and not misleading, and
- shall not include rating, judgements or direct comparison with other products[13].

An EPD should be made with a reasonable number of pages for the intended audience and use.

The content of EPDs published in machine-readable format shall correspond with the content of the underlying EPD.

5.1 EPD LANGUAGES

EPDs should be published in English but may also be published in additional languages. If the EPD is not available in English, it shall contain an executive summary in English including the main content of the EPD. This summary is part of the EPD and thus subject to the same verification procedure.

5.2 UNITS AND QUANTITIES

The following requirements apply for units and quantities:

- The International System of Units (SI units) shall be used, e.g., kilograms (kg), Joules (J) and metres (m). Reasonable multiples of SI units may be decided in the PCR to improve readability, e.g., grams (g) or megajoules (MJ). The following exceptions apply:
  - Resources used for energy input (primary energy) should be expressed as kilowatt-hours (kWh) or megajoules (MJ), including renewable energy sources, e.g., hydropower, wind power and geothermal power.
  - Water use should be expressed in cubic metres (m^3)
  - Temperature should be expressed in degrees Celsius (°C),
  - Time should be expressed in the units most practical, e.g., seconds, minutes, hours, days or years.
  - Results of the environmental performance indicators shall be expressed in the units prescribed by the impact assessment methods, e.g. kg CO_2 equivalents.
- Three significant figures[14] should be adopted for all results, The number of significant digits shall be appropriate and consistent.
- Scientific notation may be used, e.g. 1.20E+2 for 120, or 1.20E-2 for 0.012.
- The thousand separator and decimal mark in the EPD shall follow one of the following styles (a number with six significant figures shown for illustration):
  - SI style (French version): 1 234,56
  - SI style (English version): 1 234.56

  In case of potential confusion or intended use of the EPD in markets where different symbols are used, the EPD shall state what symbols are used for thousand separator and decimal mark.
- Dates and times presented in the EPD should follow the format in ISO 8601. For years, the prescribed format is YYYY-MM-DD, e.g., 2017-03-26 for March 26th, 2017.

[13] Therefore, results of normalization are not allowed to be reported in the EPD.

[14] Significant figures are those digits that carry meaning contributing to its precision. For example with two significant digits, the result of 123.45 shall be displayed as 120, and 0.12345 shall be displayed as 0.12. In scientific notation, these two examples would be displayed as $1.2*10^2$ and $1.2*10^{-2}$.

- The result tables shall:
  - Only contain values or the letters “ND” (Not Declared). It is not possible to specify ND for mandatory indicators. ND shall only be used for voluntary parameters that are not quantified because no data is available.[15]
  - Contain no blank cells, hyphens, less than or greater than signs or letters (except “ND”).
  - Use the value “0” only for parameters that have been calculated to be zero.
  - Footnotes shall be used to explain any limitation to the result value.

5.3 USE OF IMAGES IN EPD

Images used in the EPD, especially pictures featured on the cover page, may in themselves be interpreted as an environmental claim. Images such as trees, mountains, wildlife that are not related to the declared product should therefore be used with caution and in compliance with national legislation and best available practices in the markets in which the EPD is intended to be used.

5.4 EPD REPORTING FORMAT

The reporting format of the EPD shall include the following sections:

- Cover page (see Section 5.4.1)
- Programme information (see Section 5.4.2)
- Product information (see Section 5.4.3)
- Content declaration (see Section 5.4.4)
- Environmental performance (see Section 5.4.5)
- Additional information (see Section 5.4.6)
- References (see Section 5.4.9)

The following information shall be included, when applicable:

- Additional social and economic information (see Section 5.4.7)
- Differences versus previous versions (see Section 5.4.8)
- Executive summary in English (see Section 5.4.10)

5.4.1 COVER PAGE

The cover page shall include:

- Product name and image,
- Name and logotype of EPD owner,
- The text “Environmental Product Declaration” and/or “EPD”
- Programme: The International EPD® System, www.environdec.com,
- Programme operator: EPD International AB
- Logotype of the International EPD® System,
- EPD registration number as issued by the programme operator[16],
- Date of publication (issue): 20XX-YY-ZZ,

[15] This requirement does not intend to give guidance on what indicators are mandated (“shall”) or voluntary.

[16] The EPD shall not include a “registration number” if such is provided by the certification body, as this may be confused with the registration number issued by the programme operator.

- Date of revision: 20XX-YY-ZZ, when applicable,
- Date of validity; 20XX-YY-ZZ
- A note that "*An EPD should provide current information, and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com*."
- A statement of conformity with ISO 14025.
- For EPDs covering multiple products: a statement that the EPD covers multiple products and a list of all products covered by the EPD.
- For Sector EPDs: a statement that the EPD is a Sector EPD.

Where applicable, the cover page shall also include the following information:

- Information about dual registration of EPD in another programme, such as registration number and logotype.
- A statement of conformity with other standards and methodological guides.

5.4.2 PROGRAMME INFORMATION

The programme information section of the EPD shall include:

- Address of programme operator: *EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden, E-mail: info@environdec.com*
- The following statement on the requirements for comparability of EPDs, adapted from ISO 14025: *"EPDs within the same product category but from different programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison."*
- A statement that the EPD owner has the sole ownership, liability and responsibility of the EPD
- Information about verification[17] and reference PCR in a table with the following format and contents:

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
PCR: *<name, registration number, version and UN CPC code(s)>*
PCR review was conducted by: *<name and organisation of the review chair, and information on how to contact the chair through the programme operator>*
Life cycle assessment (LCA)
LCA accountability: *<name, organization>*
Third-party verification

[17] If the EPD has been verified by an approved individual verifier who has received contractual assistance from a certification body that is not accredited, this certification body shall not be included in this table.

Independent third-party verification of the declaration and data, according to ISO 14025:2006 via: ☐ EPD verification by individual verifier Third-party verifier: <*name, organisation, and signature of the third-party verifier*> Approved by: The International EPD® System
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by accredited certification body Third-party verification: <*name, organisation*> is an approved certification body accountable for the third-party verification The certification body is accredited by: <*name of accreditation body & accreditation number, where applicable*>
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006 via: ☐ EPD verification by EPD Process Certification* Internal auditor: <*name, organisation*> Third-party verification: <*name, organisation*> is an approved certification body accountable for third-party verification Third-party verifier is accredited by: <*name of accreditation body & accreditation number, where applicable*> *For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see GPI v4, Section 7.5
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☐ No

5.4.3 PRODUCT INFORMATION

The product information section of the EPD shall include:

- Address and contact information to EPD owner,
- Description of the organisation. This may include information on products- or management system-related certifications (e.g. ISO 14024 Type I environmental labels, ISO 9001- and 14001-certificates and EMAS-registrations) and other relevant work the organisation wants to communicate (e.g. SA 8000, supply-chain management and social responsibility),
- Name and location of production site,
- Product identification by name, and an unambiguous identification of the product by standards, concessions or other means,
- Identification of the product according to the UN CPC scheme system. Other relevant codes for product classification may also be included, e.g.
    - Common Procurement Vocabulary (CPV),
    - United Nations Standard Products and Services Code® (UNSPSC),

- Classification of Products by Activity (NACE/CPA) or
- Australian and New Zealand Standard Industrial Classification (ANZSIC),
- Global Trade Item Number (GTIN).

- Description of the product, its application/intended use and technical functions, e.g. expected service life time (lifespan),
- For EPDs covering multiple products: a description of the selection of products/sites, a list of contributing manufacturers (if Sector EPD), etc. (see Section 4.9),
- Geographical scope of the EPD, i.e., for which geographical location(s) of use and end-of-life the product's performance has been calculated,
- Functional unit or declared unit,
- Declaration of the year(s) covered by the data used for the LCA calculation and other relevant reference years,
- Reference to the main database(s) for generic data and LCA software used, if relevant,
- System diagram of the processes included in the LCA, divided into the life cycle stages,
- Description if the EPD system boundary is "cradle-to-gate", "cradle-to-gate with options" or "cradle-to-grave",
- Information on which life cycle stages are not considered (if any), with a justification of the omission,
- Relevant websites for more information or explanatory materials.

This section may also include:

- Name and contact information of organisation carrying out the underlying LCA study,
- Additional information about the underlying LCA-based information, such as assumptions, cut-off rules, data quality and allocation.

5.4.4 CONTENT DECLARATION

The content declaration section shall declare the weight of one unit of product, as purchased, and contain information about the content of the product in the form of a list of materials and chemical substances including information on their environmental and hazardous properties. The gross weight of material/substances shall be declared in the EPD at a minimum of 95% of the materials/substances in one unit of product.

The used materials of the rolling stock shall be classified into the following categories, according to ISO 21106 or UNI-LCA-001 and be included in the EPD.

- metals (ferrous metals or non-ferrous metals);
- elastomers;
- polymers (thermosets or thermoplastics);
- composites (e.g., fibre reinforced polymers or others);
- electric and electronic equipment;
- glass;
- safety glass;
- oil, grease or similar;
- acids, cooling agents or similar;
- other inorganic materials (e.g., ceramics);
- mineral wool;
- modified organic natural materials (MONM), including wood.

The major railway industry companies have agreed on a common management methodology including a list of substances that are to be controlled, the Railway Industry Substance List, available at http://www.unife-database.org/download.php. The list provides a comprehensive and accurate list of the prohibited and declarable chemicals used specifically by the railway industry.
Information on the hazardous properties of materials and chemical substances should follow the requirements given in the latest revision of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS),[18] issued by the United Nations or national or regional applications of the GHS.

5.4.4.1. Information about recycled materials

When a product is made in whole or in part with recycled materials, the provenience of the materials (pre-consumer or post-consumer) may be presented in the EPD as part of the content declaration as weight-% of the total product weight.

According to current maturity on the recycled content inventory for rolling stock (few information from supply chain, no specific rates, no visibility on exclusion of scrape reutilisation) and modelling option in LCA (data set available), the reliability of such data is considered as low. Thus, information on recycled content is not required as a separated data in the content declaration of EPD. Nevertheless, when possible and relevant, LCA study could include secondary materials modelling. In this case, following rules are applied:

- The environmental impacts related to the recycled materials from “previous life cycle” shall calculated according to section 4.6.2.

To avoid any misunderstanding about which material may be considered “recycled material”, the guidance given in ISO 14021 shall be taken into account. In brief, the standard states that:

- only pre-consumer or post-consumer materials (scraps) shall be considered in the accounting of the recycled materials, and
- materials coming from scrap reutilisation (such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it) shall not be considered as recycled content.

5.4.5 ENVIRONMENTAL PERFORMANCE

Below subsections list the mandatory environmental performance indicators to be declared in the EPD. LCA results based on additional indicators may be declared, if they are relevant for the product category, their inclusion is justified in the EPD, appropriate methods[19] are used, and the results are verifiable. If the additional indicators appear to the reader to display duplicate information, the EPD shall contain an explanation of the differences between the declared indicators.

5.4.5.1. Environmental impacts

The EPD shall declare the environmental impact indicators, per declared/functional unit, per life-cycle stage and in aggregated form, using the default impact categories, impact assessments methods and characterisation factors available at www.environdec.com/indicators. The source and version of the impact assessment methods and characterisation factors used shall be reported in the EPD.

In addition to the default list of environmental impact categories listed on www.environdec.com/indicators, the potential incidence of disease due to particle matter emissions calculated according to EN15804 shall be include in the results.

Alternative regional life cycle impact assessment methods and characterisation factors may be calculated and displayed in addition to the default list. If so, the EPD shall contain an explanation of the difference between the different sets of indicators, as they may appear to the reader to display duplicate information.

[18] The GHS document is available at www.unece.org.

[19] If any of the following impact categories are declared in the EPD, the corresponding characterisation methods listed in EN 15804 should be used: particulate matter emissions, ionizing radiation (human health), eco-toxicity (freshwater), human toxicity (cancer effects), human toxicity (non-cancer effects) and land use related impacts/soil quality. If these impact categories and characterisation methods are used, the corresponding disclaimers listed in EN 15804 shall be declared in the EPD.

5.4.5.2. Use of resources

The EPD shall declare the indicators for resource use listed at www.environdec.com/indicators per declared/functional unit, per life-cycle stage and in aggregated form.

5.4.5.3. Waste production and output flows

Waste generated along the whole life cycle production chains shall be treated following the technical specifications described in the GPI. The EPD shall declare the indicators for waste production and output flows as listed at www.environdec.com/indicators per declared/functional unit, per life-cycle stage and in aggregated form.

5.4.6 ADDITIONAL INFORMATION

An EPD may declare additional environmentally relevant information, in addition to the LCA results of the section on environmental performance results. The additional environmental information may cover various aspects of specific relevance for the product, for example:

- the release of dangerous substances into indoor air, soil, and water during the use stage,
- instructions for proper use of the product, e.g. to minimise energy or water consumption or to improve the durability of the product,
- instructions for proper maintenance and service of the product, e.g. to minimise energy or water consumption or to improve the durability of the product,
- information on key parts of the product that determine its durability,
- information on recycling including, e.g. suitable procedures for recycling the entire product or selected parts and the potential environmental benefits gained,
- information on a suitable method of reuse of the product (or parts of the products) and procedures for disposal as waste at the end of its life cycle,
- information regarding disposal of the product, or inherent materials, and any other information considered necessary to minimise the product's end-of-life impacts, and
- a more detailed description of an organisation's overall environmental work, in addition to the information listed under Section 5.4.3, such as:
  - the existence of any type of organised environmental activity, and
  - information on where interested parties may find more details about the organisation's environmental work.

Any additional environmental information declared shall be substantiated and verifiable, and be derived using appropriate methods and be specific, accurate, not misleading, and relevant to the specific product. Quantitative information is preferred over qualitative information.

5.4.6.1. Rail vehicle energy consumption

The following product related information shall be declared in the EPD:

- Electricity consumption – for electric/battery rolling stock
  - Carbon dioxide intensity data (kg CO_2e/kWh) shall be included in the EPD if publication of this information is accepted by the data provider.
- Fuel consumption – for diesel/H2 rolling stock

All major assumptions for the model of rail vehicle operation made according to Section 4.7.3.3 shall be included in the EPD. Those shall include, but are not limited to:

- Total number of passengers used in the calculations
- Load factor [%] (mandatory for freight vehicles, optional for passenger vehicles)

5.4.6.2. Noise emissions

The noise emissions of the rail vehicle shall include, but is not limited to, outside noise measured during rail vehicle type testing:

- Stationary noise
- Starting noise
- Pass-by noise

The standard used to perform the measurements shall be declared in the EPD.

5.4.6.3. Recyclability and Recoverability

The recyclability and recoverability rates of the rail vehicle shall be calculated according to the ISO 21106 which provides detailed information on the calculation steps and the material recycling figures. Other standards like UNI-LCA-001 or ISO 22628 may be used to calculate the recyclability and recoverability rates and the results included in the EPD, however results of the ISO 21106 shall always be included in the EPD. The standard used to perform the calculation shall be declared in the EPD.

5.4.6.4. PM10 and NOx emission values for diesel rolling stock

The PM_{10} and NO_x emissions shall be declared for diesel rolling stock in the EPD. The values shall be those of the actual measurements during rail vehicle type testing. The standard used for type testing shall also be declared in the EPD.

5.4.7 ADDITIONAL SOCIAL AND ECONOMIC INFORMATION

The EPD may also include other relevant social and economic information as additional and voluntary information. This may be product information or a description of an organisation's overall work on social or economic sustainability, such as activities related to supply chain management or social responsibility.

Any additional social and economic information declared shall be substantiated and verifiable, and be derived using appropriate methods and be specific, accurate, not misleading, and relevant to the specific product. Quantitative information is preferred over qualitative information.

5.4.8 DIFFERENCES VERSUS PREVIOUS VERSIONS

For EPDs that have been updated, the following information shall also be included:

- a description of the differences versus previously published versions, and
- a revision date on the cover page

5.4.9 REFERENCES

This section shall include a list of relevant references, including:

- General programme instructions (including version number)
- The PCRs used (registration number, name and version).
- Standards
- The underlying LCA report
- Reference to methodology and version used for each impact category
- Instructions for recycling
- Other documents that verify and complement the EPD

5.4.10 EXECUTIVE SUMMARY IN ENGLISH

The executive summary, if included (see Section 5.1), shall contain relevant summarised information related to the programme, product, environmental performance, information related to pre-certified EPDs, and information related to sector EPDs. Besides this,

further information may be added such as additional environmental, social or economic information, references as well as differences versus previous EPD versions.

6 GLOSSARY

ANZSIC	Australian and New Zealand Standard Industrial Classification
CO_2	Carbon dioxide
CPC	Central product classification
CPV	Common procurement vocabulary
EPD	Environmental product declaration
GPI	General Programme Instructions for environmental product declarations
GTIN	Global trade item number
ISO	International Organization for Standardization
kg	kilogram
LCA	Life cycle assessment
LCI	Life Cycle Inventory
MONM	Modified organic natural materials
MPG	Main product group
NACE/CPA	Classification of products by activity
ND	Not declared
PCR	Product Category Rules
PG	Product group
REACH	Restriction of chemicals
RISL	Railway Industry Substance List
RSL	Reference service life
SI	The International System of Units
SPG	Sub product group
STC	Sustainable Transport Committee at UNIFE
UIC	Union Internationale des Chemins de Fer – International Union of Railways
UN	United Nations
UNCPC	United Nations Central Product Classification
UNIFE	Union des Industries Ferroviaires Européennes – The Association of the European Rail Industry

6.1 TERMS AND DEFINITIONS

The following table describes the terms and definitions used in this PCR document.

TERM	DEFINITION
Allocation	Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems. [ISO 14040]
Co-product	Any of two or more products coming from the same unit process or product system. [ISO 14040]
Cut-off criteria	Specification of the amount of material or energy flow or the level of environmental significance associated with unit processes or product systems to be excluded from a study. [ISO 14040]
Data quality	Characteristics of data that relate to their ability to satisfy stated requirements. [ISO 14040]
Energy consumption	In the context of this PCR, energy consumption means e.g. energy utilization or energy usage. Energy cannot be “consumed”, only utilized or converted between different kinds of energy, e.g. chemical energy (in fuels), kinetic energy, potential energy, heat, electric energy etc. The term ‘energy consumption’ is used because it is common terminology in the railway sector.
EPD® System	The international EPD® System is a communication tool for international markets. See more details at www.environdec.com.
Functional unit	Quantified performance of a product system for use as a reference unit. [ISO 14040]
Generic data	Also referred to as secondary data – data from commonly available data sources (e.g. commercial databases and free databases), which are allowed to be used to substitute specific data providing if they fulfil prescribed characteristics. [GPI]
Impact category	Class representing environmental issues of concern to which life cycle inventory analysis results may be assigned. [ISO 14040]
Life Cycle Assessment	Compilation of life cycle inventories involving the gathering and quantification of inputs and outputs for a product system throughout its entire life cycle. [ISO 14040]
Load factor	The ratio between the number of passenger-km and the offered number of seat-km. Load factor is sometimes called seat occupancy rate. [KTH 2006]
Net energy	Amount of energy remaining after feeding back energy to network through regenerative braking, energy recovery.
Process	Set of interrelated or interacting activities that transform inputs into outputs. [ISO 14040]
Product	Any goods or service. The product can be categorized as follows: - services (e.g. transport) - software (e.g. computer program, dictionary) - hardware (e.g. engine mechanical part) - processed materials (e.g. lubricants) [ISO 14040]
System boundary	Set of criteria specifying which unit processes are part of a product system. [ISO 14040]

Specific data	Also referred to as primary data – data gathered from the actual manufacturing plant where product specific processes are carried out. [GPI]
Tier 1 supplier	A direct supplier, selling their goods or services directly without intermediate supplier to a procuring entry.
Unit process	Smallest element considered in the life cycle inventory analysis for which input and output data are quantified. [ISO 14040]
Waste	Substances or objects which the holder intends or is required to dispose of. [2008/98/EC]

Table 4 Terms and definitions.

7 REFERENCES

1907/2006/EC, Regulation (EC) No. 1907/2006, concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

2008/98/EC, Directive 2008/98/EC on waste

CEN (2016), EN 15380-2:2016, Railway applications-Designation system for railway vehicles- Part 2 Product Groups

CEN (2017), EN 15663:2017 + A1:2018, Railway Applications – Definition of Vehicle Reference Masses

EN (2019), EN 50591:2019, Railway Applications - Rolling Stock - Specification and verification of energy consumption

EPD International (2017) General Programme Instructions for the International EPD® System. Version 3.0, dated 2017-12-11. www.environdec.com

EPD International (2021) General Programme Instructions for the International EPD® System. Version 4.0, dated 2021-03-29. www.environdec.com

EPD International (2018) PCR Basic module CPC 49 Transport equipment, version 3.0, dated 2018-05-03. www.environdec.com

EPD International (2022) PCR template for GPI 4.0 (version 2023-03-23)

ISO (2000), ISO 14020:2000, Environmental labels and declarations – General principles

ISO (2002), ISO 22628:2002, Road vehicles-Recyclability and recoverability –Calculation method

ISO (2004), ISO 8601:2004 Data elements and interchange formats – Information interchange – Representation of dates and times

ISO (2006a), ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO (2006b), ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework

ISO (2006c), ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines

ISO (2013) ISO/TS 14067:2013, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication.

ISO (2014), ISO 14046:2014, Environmental management – Water footprint – Principles, requirements and guidelines

ISO (2015a) ISO 14001:2015, Environmental management systems – Requirements with guidance for use.

ISO (2015b) ISO 9001:2015, Quality management systems – Requirements.

ISO (2016b) ISO 14021:2016, Environmental labels and declarations - Self-declared environmental claim (Type II environmental labelling).

ISO (2019), ISO 21106:2019, Railway applications — Recyclability and recoverability calculation method for rolling stock, planned to be release in 2019

KTH (2006), Andersson, E. & Lukaszewicz, P.: Energy consumption and related air pollution for Scandinavian electric passenger trains, KTH

TSI (2014), Commission Regulation (EU) No 1304/2014 of 26 November 2014 on the technical specification for interoperability relating to the subsystem rolling stock — noise amending Decision 2008/232/EC and repealing Decision 2011/229/EU

UNI-LCA-001 (2013), UNIFE Recyclability and Recoverability Calculation Method Railway Rolling Stock

8 VERSION HISTORY OF PCR

VERSION 1.0, 2009-12-01

Original version.

VERSION 1.1, 2010-04-23

Minor update.

VERSION 2.0, 2013-02-04

General update of the document with new validity.

VERSION 2.1, 2014-05-27

- Editorial changes, such as moving the abbreviations, terms and definitions and references to the end of the document and spell checks.
- Changes to comply with the latest General Programme Instructions, published in 2013:
  - General introduction updated to latest version.
  - Table in General information complemented with additional information (Section 1).
  - Updated data quality requirements for the Core Module to reflect the latest priority list (Section 9.4).
  - Use of resources updated (Section 11.1).
  - Reference to characterisation factors on www.environdec.com added (Section 11.3).
  - Section on validity of EPD updated with latest version (Section 15).
  - Added reference.
- Added missing reference that a maximum of three significant digits shall be used to report results.
- Added missing sub-chapter Content declaration (Section 14.3).

VERSION 2.11, 2014-10-29

Corrected first sentence in Section 11 to “In the LCA report and in the EPD all data shall be declared per functional unit or as total value if appropriate for the (...)”

VERSION 2.12, 2018-01-15

- Updated validity to 2018-12-31 in accordance with Section 5.5.1 of the General Programme Instructions to allow time for the update.
- Minor editorial changes.

VERSION 3.0, 2018-12-27

- Mayor editorial changes to the meet the PCR format specified by General Programme Instructions version 3.0 and basic module CPC 49 Transport equipment version 3.0.
- Overall section structure changed
  - General information (Section 2), Table updated with additional information, scope of PCR has been moved to this section. Scope definition clarified the use of PCR for a reduced scope (Section 2.2.1).

- The life cycle inventory section (Section 4) has been rearranged and common rules regarding the different life cycle modules have been clustered.
- Section 4.9.3.2 ISO 21106 has been added as additional method for end-of-life modelling.
- Complete description of the content of an EPD has been added (Section 5).
- New impact categories have been added
    - Section 5.4.5.1:
        - Formation potential of tropospheric ozone (POCP or POFP).
        - Abiotic depletion potential – Elements.
        - Abiotic depletion potential – Fossil fuels.
    - Section 5.4.5.3
        - Waste production divided on all life cycle stages.
        - Detailed information on output flows.

VERSION 3.01, 2019-08-18

- Clarified terms of use.
- Editorial changes.

VERSION 3.02, 2020-02-14

- Deletion of reference in reference list not referred to in the document.
- Editorial changes.

VERSION 3.03, 2020-11-27

- Editorial changes.

VERSION 3.04, 2021-07-05

- Changed affiliation and contact information of PCR Moderator.

VERSION 4.0.0, 2023-07-06

- Changes to the meet the PCR format and content as specified by General Programme Instructions version 4.0 and the PCR template for GPI 4.0 dated 2023-03-23 have been done throughout the PCR.
- References to EN 15804 and ISO 21930 removed.
- Members of the PCR committee updated, Bombardier Transportation removed, Hitachi Rail and Voestalpine added.
- Battery and H2 powered vehicles added to vehicle scope.
- Section 4.3.1.1 clarifications added to auxiliary materials, transportation and supplier production.
- Section 4.3.1.2 Internal transports added in included processes, validation/testing added to excluded processes.
- Section 4.3.2 Infrastructure and capital goods added as per latest PCR template.
- Section 4.3.3.1 Boundary in time updated to match PCR template.
- Section 4.3.3.3 added clarification related to geographical boundaries of the EPD.
- Section 4.7.2 recommended databases, reference to Thinkstep-GaBi has been replaced by Sphera-LCA for Experts.

- Old section 4.9 Other calculation rules and scenarios moved and renamed to 4.7.3 Data Quality requirements and other modelling guidance per life cycle stage.
- Section 4.7.3.3.1 Use phase scenario has been updated with details on how to present different use scenarios in the same EPD.
- To section 4.7.3.3.2 End of Life Scenarios reference to ISO 21106 has been added.
- Old section 4.8 Impact categories and impact assessment has been renamed to 4.8 Environmental performance indicators, content update with minor changes.
- Environmental performance indicators in section 5.4.5 has been removed and replaced with reference to the Environdec webpage.
- Section 5.4.6.2 updated to match the vocabulary of the TSI (2014) for rolling stock.
- Changed the name of the PCR from “Rolling stock” to “Rolling stock and parts thereof”.

VERSION 4.0.1, 2023-07-31

- Minor editorial changes

VERSION 4.0.2, 2023-10-06

- Minor editorial changes