

ARABLE CROPS

PRODUCT CATEGORY CLASSIFICATION: UN CPC 011, 014, 017, 019

2013:05
VERSION 2.01

VALID UNTIL: 2020-12-15



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GENERAL INTRODUCTION TO PRODUCT CATEGORY RULES IN THE INTERNATIONAL EPD® SYSTEM

This document constitutes Product Category Rules (PCR) developed in the framework of the International EPD® System: a programme for type III environmental declarations according to ISO 14025:2006. Environmental Product Declarations (EPD®) are voluntary documents for a company or organisation to present transparent information about the life cycle environmental impact for their goods or services.

The rules for the overall administration and operation of the program are the General Programme Instructions, publically available at the website (www.environdec.com). In addition to ISO 14025, the International EPD® System adheres to the following international standards:

- ISO 9001, Quality management systems
- ISO 14001, Environmental management systems
- ISO 14040, LCA - Principles and procedures
- ISO 14044, LCA - Requirements and guidelines

For construction products, the International EPD® System also allows the use of EN 15804 (Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products) and ISO 21930 (Environmental declaration of building products) as the main underlying standards. The compliance with these and other standards shall be clearly stated in each PCR and EPD® where it is relevant.

A PCR is defined in ISO 14025 as a set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories. The PCR document specifies the rules for the underlying life cycle assessment (LCA) and sets minimum requirements on EPDs for a specific product group that are more detailed than the standards and the General Programme Instructions.

PCRs in the International EPD® System are developed in English in accordance with the procedure described in the General Programme Instructions. All PCR documents have a maximum period of validity after which the document shall be revisited. The template used for this PCR is based on the PCR template provided by the Guidance for Product Category Rule Development (2013).

Within the present PCR, the following terminology is adopted, as defined by the Guidance for Product Category Rules Development v1.0:

- The term “shall” is used to indicate what is obligatory.
- The term “should” is used to indicate a recommendation, rather than a requirement.
- The term “may” or “can” is used to indicate an option that is permissible

EPDs are developed and registered based on a valid PCR. An EPD® shall be based on the latest version of the PCR, and refer to the version number and date of the PCR used. The production of new PCR versions does not affect the certification period of EPDs that are already published.

This PCR document is publically available at www.environdec.com. The PCR document is a living document. If relevant changes in the LCA methodology or in the technology for the product category occur, the document will be revised and the new version will be published on the website.

Stakeholder feedback on PCRs is very much encouraged. Any comments to this PCR document may be given on the PCR Forum on www.environdec.com or directly to the PCR moderator during its development or during the period of validity.

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1 GENERAL INFORMATION

1.1 ADMINISTRATIVE INFORMATION

| | |
|--------------------------|--|
| Name: | Arable crops |
| Registration number: | 2013:05, Version 2.01 |
| Programme operator: | The International EPD® System operated by EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. Website: www.environdec.com E-mail: info@environdec.com |
| Appointed PCR moderator: | Filippo Sessa, Life Cycle Engineering, sessa@studiolce.it |
| PCR Committee: | Filippo Sessa, Life Cycle Engineering, sessa@studiolce.it Nicola Robinson, McDonald's Europe, nicola.robinson@eu.mcd.com Pauline Maupu, Amandine Berthoud, InVivo Group, pmaupu@invivo-group.com , aberthoud@invivo-group.com Frank Brentrup, Yara, frank.brentrup@yara.com Pekruhn Margit, Lieken, margit.pekruhn@lieken.de Chrystel Bogiraud, East Balt France, cbogiraud@eastbalt.fr |
| Date of publication: | 2020-11-16 (Version 2.01) Version 1.0 was published 2013-06-12. A version history is available in Section 10. |
| Date of expiration: | 2020-12-15 |
| Schedule for renewal: | When the validity time is about to expire the PCR moderator shall initiate a discussion with the programme operator how to proceed with updating the document and extending the period of validity. See General Programme Instructions, Section C.5. |
| Standards conformance: | <ul style="list-style-type: none"> ▪ General Programme Instruction of the International EPD® System, version 2.5, based on ISO 14025 and ISO 14040/14044 ▪ PCR Basic Module, CPC Division 01: Products of agriculture, horticulture and market gardening, version 2.5, dated 2015-12-22 |
| PCR language: | This PCR was developed and is available in English, as is mandated by the General Programme Instructions. |
| Comments on the PCR: | Any comments to this PCR document may be given on the PCR Forum on www.environdec.com or sent directly to the PCR moderator during the period of validity. |

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1.2 SCOPE OF PCR

1.2.1 PRODUCT CATEGORY DEFINITION

This document provides Product Category Rules (PCR) for the assessment of the environmental performance of Arable crops corresponding to UN CPC 011, 014, 017, 019 and the declaration of this performance by an EPD®.

Included in this product group are cereals, oilseeds, pulses and forage products; see below. Pseudocereals (e.g. buckwheat, quinoa), although not included in any CPC group, have to be considered arable crops and therefore included in this product group.

Group: 011 – Cereals

- 0111 (Wheat)
- 0112 (Maize)
- 0113 (Rice)
- 0114 (Sorghum)
- 0115 (Barley)
- 0116 (Rye)
- 0117 (Oats)
- 0118 (Millet)
- 0119 (Other cereals)

Group: 014 - Oilseeds and oleaginous fruits

- 0141 (Soya beans)
- 0142 (Groundnuts in shell)
- 0143 (Cottonseed)
- 0144 (Other oilseeds)

Group: 017 - Pulses (dried leguminous vegetables)

- 0170 (Pulses)

Group: 018 – Sugar crops

- 01801 - Sugar beet
- 01802 - Sugar cane
- 01803 - Sugar beet seeds
- 01809 - Other sugar crops n.e.c.

Group: 019 - Forage products, fibres, living plants, cut flowers and flower buds, unmanufactured tobacco, and natural rubber

- 01911 (Maize for forage and silage)
- 01912 (Alfalfa for forage and silage)

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- 01913 (Cereal straw, husks, unprepared, ground, pressed, or in the form of pellets)
- 01919 (Forage products, n.e.c.)

The product group and CPC code, if available, shall be specified in the EPD.

1.2.2 GEOGRAPHICAL REGION

This PCR document can be apply globally.

1.2.3 EPD® VALIDITY

The maximum validity of EPDs based on this PCR shall be three years after which the declaration must necessarily be revised and reissued.

During the validity period of the EPD, surveillance follow up shall be agreed between the EPD owner and the verifier in order to evaluate if the content are still consistent with the current situation, or if the EPD must be updated. See the General Programme Instructions of the International EPD® System for further information and requirements.

2 PCR REVIEW AND BACKGROUND INFORMATION

2.1 PCR REVIEW (VERSION 1.0)

Version 1.0 of this PCR was reviewed by the Technical Committee of the International EPD® System.

2.2 PCR REVIEW (VERSION 2.0)

| | |
|--------------------------|---|
| PCR review panel: | The Technical Committee of the International EPD® System. A full list of members available on www.environdec.com/TC . The PCR 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. |
| Review dates: | 2016-05-02 until 2016-06-20 |
| Chair of the PCR review: | Maurizio Fieschi |

2.3 OPEN CONSULTATION

2.3.1 VERSION 1.0

Version 1.0 of this PCR was available for open consultation from 2013-03-06 until 2013-04-19 at www.environdec.com.

2.3.2 VERSION 2.0

This PCR was available for open consultation from 2016-02-24 until 2016-04-24, 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.

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A total of 231 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.

2.4 EXISTING PCRS FOR THE PRODUCT CATEGORY

This PCR document is the version 2.0 of the PCR 2013:05 Arable crops of the International EPD system. No PCRs have been possible to identify for the product category in other programmes based on ISO 14025.

2.5 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed in order for the possibility to develop and publish EPD[®] for the product category in the International EPD[®] System. This document is also a cross-cutting PCR document developed to ensure that the production of Arable crops is evaluated with the same methodology in all the PCRs in which arable crops production is an upstream process. All these PCRs should refer to the PCR for arable crops when defining rules and requirements for the cultivation process.

2.6 UNDERLYING STUDIES

- Bouwman, A. F., L. J. M. Boumans, and N. H. Batjes, 2002, Modeling global annual N₂O and NO emissions from fertilized field
- EMEP/CORINAIR Emission Inventory Guidebook - 3rd edition October 2002
- Frischknecht R, Steiner R, & Jungbluth N, The Ecological Scarcity Method – EcoFactors (2006b): A method for impact assessment in LCA. 2009, Federal Office for the Environment FOEN: Zürich und Bern.
- IPCC, 2006. Guidelines for National Greenhouse Gas Inventories
- Milà i Canals L, Romanyà J, Cowell SJ (2007b). Method for assessing impacts on life support functions (LSF) related to the use of 'fertile land' in Life Cycle Assessment (LCA). J Clean Prod 15 1426-1440
- Nemecek T., Kagi Thomas, 2007. Life Cycle Inventories of Agricultural Production Systems. Ecoinvent report No.15
- Prahsun V., 2006. Erfassung der PO₄-Austrage für die Okobilanzierung SALCA Phosphor. Agroscope Reckenholz –Tanikon ART, 20p

3 GOAL AND SCOPE

3.1 DECLARED UNIT

The declared unit shall be defined as 1 kg of product, including its packaging. The reference flow in the Life Cycle Assessment shall be defined at the customer gate, at the shelf or the retailer or at the market place.

The product moisture and nutrients content shall be specified.

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 should be included in the EPD[®], if relevant.

3.2 SYSTEM BOUNDARIES

The International EPD[®] System has adopted an LCA calculations procedure which is separated into three different life cycle stages:

- Upstream processes (from cradle-to-gate);

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- 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.

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

3.2.1 UPSTREAM PROCESSES

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

- Production of seeds, cuttings or plants for the cultivation
- Production of fertilizers used in the agriculture
- Impacts due to the production of electricity and fuels used in the upstream module
- Production of auxiliary products used such as detergents for cleaning, etc.
- Production of semiproducts used in the core process, if applicable
- Manufacturing of primary and secondary 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 1 % cut-off rule.

3.2.2 CORE PROCESSES

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

- External transportation to the core processes
- Agriculture including e.g. operations at the farm(s), air and water emissions from energy wares used in the agriculture as well as air, water and soil emissions from agriculture. The cradle for the agriculture is soil preparation and cultivation.
- Maintenance (e.g. of the machines)
- Preparation of the final product
- Waste treatment of waste generated during manufacturing;
- Impacts due to the production of electricity and fuels used in the core module
- Impacts due to the production of agricultural machinery (e.g. tractors, plows, planters, harvesters, etc.)

Manufacturing processes not listed may also be included. However, the production of the raw materials used for production of all product parts shall be included. A minimum of 99% of the total weight of the declared product including packaging shall be included.

The technical system shall not include:

- Manufacturing of buildings and capital goods other than agricultural machinery
- Business travel of personnel.
- Travel to and from work by personnel.
- Research and development activities.

3.2.3 DOWNSTREAM PROCESSES

The following attributional processes are part of the product system and classified as downstream processes:

- Transportation from agriculture, horticulture and market gardening, to an average customer or consumer.

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- End-of-life processes of any wasted part of the product
- End-of-life processes of packaging waste.

As the possible uses are varied, it is not possible to define a credible scenario for the use phase. This phase shall be therefore excluded from the study.

3.3 SYSTEM DIAGRAM

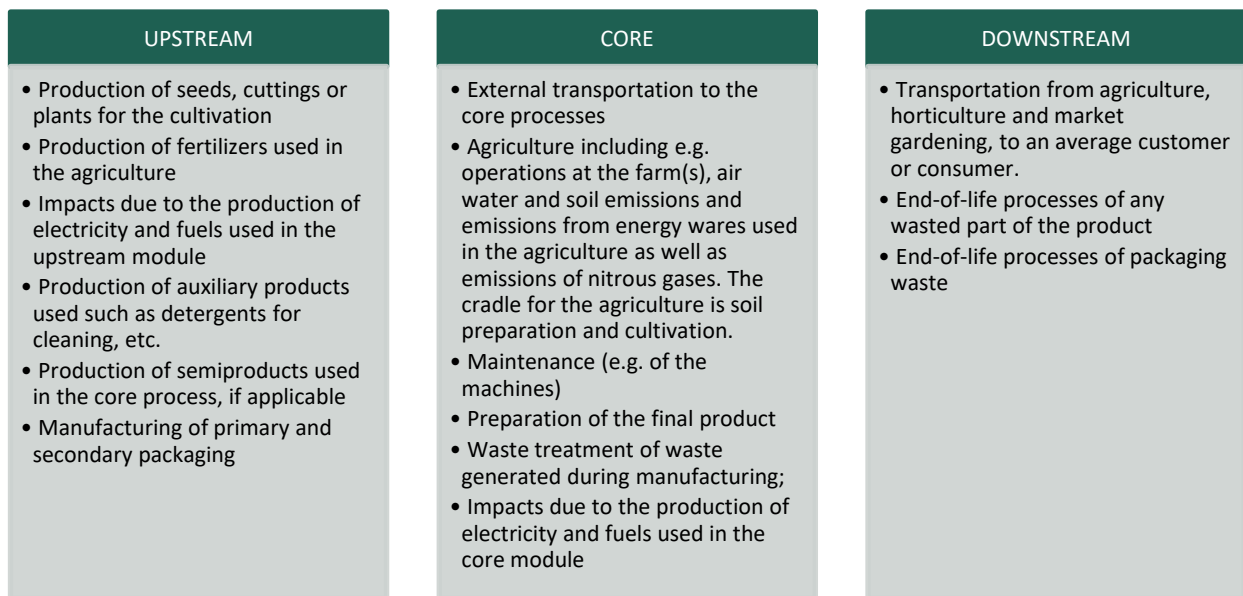


Figure 1. System diagram illustrating the processes that are included in the product system, divided into upstream, core and downstream processes. It should be indicated if any omissions of life cycle stages are made in order to make the EPD® cover the full cradle-to-grave perspective.

3.4 DATA QUALITY REQUIREMENTS

As a general rule, specific data shall always be used, if available, after performing data quality assessment. Specific data shall be used for the core processes. For the upstream processes, downstream processes and infrastructure generic data may also be used if specific data are not available. Generic data should especially be used in cases where 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.

Any data used should preferably represent average values for a specific reference year. However, the way these data are being generated could vary, e.g. over time, and in such cases they should have the form of a representative annual average value for a specified reference period. Such deviations should be declared.

4 LIFE CYCLE INVENTORY

Life cycle inventory (LCI) data for a minimum of 99 % of total inflows to the core module shall be included. Inflows not included in the LCA shall be documented in the EPD. It is important to emphasize that – in most cases – all available data shall be used. Using cut-off rules should not give the perceptions of “hiding” information, but rather to facilitate the data collection for practitioners.

Data on life cycle of materials or energy inputs are classified into three categories - specific data, selected generic data and proxy data, defined as follows:

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- **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, and data from other parts of the life cycle traced to the specific product system under study, e.g. materials or electricity provided from a contracted supplier being able to provide data for the actual delivered services, transportation taking place based on the actual fuel consumption and related emissions, etc.,
- **generic data** (sometimes referred to as secondary data), divided into:
 - **selected generic data** – data from commonly available data sources (e.g. commercial databases and free databases) that fulfil prescribed data quality characteristics for precision, completeness and representativeness,
 - **proxy data** – data from commonly available data sources (e.g. commercial databases and free databases) that do not fulfil all of the data quality characteristics of “selected generic data”.

4.1 REQUIREMENTS REGARDING COLLECTION OF SPECIFIC DATA

Specific data shall be gathered from the actual manufacturing plant(s) where specific processes are carried out and data from other parts of the life cycle traced to the specific product system under study, e.g. materials or electricity provided from a contracted supplier being able to provide data for the actual delivered services, transportation taking place based on the actual fuel consumption and related emissions, etc.

4.2 REQUIREMENTS REGARDING GENERIC DATA

The attributional (“book-keeping”) LCA approach in the International EPD® System forms the basic prerequisites for selecting generic data. This means that data based on a consequential systems’ approach shall not be used. Data calculated with substitution (system expansion where include benefits from “avoided production”) to solve allocation problems should not be used, but if no other data is available, such data may be accepted as proxy data if negative flows are changed to zero.

For allowing the use of selected generic data selected prescribed characteristics for precision, completeness and representativeness must be fulfilled and demonstrated, including but not limited to:

- Reference year to be as actual as possible, preferably being representative for at least 5 years,
- Cut-off criteria to be met on the level of the modelled product system are the qualitative coverage of at least 99% of-both the energy, the mass, and the overall relevance of the flows,
- Completeness where the inventory data set should in principle cover all elementary flows that contribute to a relevant degree of the impact categories, and
- Representativeness of the resulting inventory for the good or service in the given geographical reference should, as a general principle, be better than $\pm 5\%$.

If selected generic data that meets the requirements of the International EPD® System are not available as the necessary input data, proxy data may be used and documented. The environmental impacts associated to proxy data must not exceed 10% of the overall environmental impact from the product system.

The EPD may include a data quality declaration to demonstrate the share of specific data, selected generic data and proxy data for the environmental impacts.

If relevant, the EPD may include a reference to the database(s) used.

4.3 MODELING PARAMETERS AND ASSUMPTIONS

4.3.1 UPSTREAM PROCESSES

The following requirements apply to the upstream processes:

- Data referring to processes and activities upstream in the supply chain, over which an organisation has a direct management control, shall be specific and collected on site.

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- Data referring to contractors supplying main parts or main auxiliaries should be asked for from the contractor as specific data, as well as infrastructure, if relevant.
- Transport of main parts and components along the supply-chain to a distribution point (e.g. a stockroom or warehouse) where the final delivery to the manufacturer can take place should be based on the actual transportation mode, distance from the supplier and vehicle load.
- In case specific data are lacking, selected generic data may be used. If this is also lacking, proxy data may be used.
- Electricity production impacts should be accounted for in this priority when specific data is used in the upstream processes:
 1. Specific electricity mix from electricity supplier as documented by Renewable Energy Certificates (RECs) or Guarantees of Origin,
 2. Electricity supplier's residual electricity mix,
 3. National electricity production mix/electricity mix on the market (preferably residual mix, otherwise national electricity production mix).

The mix of electricity used in the upstream processes shall be documented, if relevant.

4.3.2 CORE PROCESSES

The following requirements apply to the core processes:

- Specific data shall be used for assembly of the product and for manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., if relevant.
- Electricity production impacts should be accounted for in this priority for the core processes:
 1. Specific electricity mix from electricity supplier as documented by Renewable Energy Certificates (RECs) or Guarantees of Origin,
 2. Electricity supplier's residual electricity mix,
 3. National electricity production mix/electricity mix on the market (preferably residual mix, otherwise national electricity production mix).

The mix of electricity used in the core processes shall be documented, if relevant.

- Transport from the final delivery point of raw materials, chemicals, main parts and components (see above regarding upstream processes) to the manufacturing plant/place of service provision should be based on the actual transportation mode, distance from the supplier and vehicle load.
- Waste treatment processes of manufacturing waste should be based on specific data, if available.
- If there are no site or region-specific data available, emissions due to fertilizer use shall be calculated according to the rules presented in the paragraphs from 4.3.2.1 to 4.3.2.5.

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| | Emission | Paragraph | Source |
|--------------------------|---------------------------------------|-----------|---|
| Emission in air | Ammonia | 8.4.1 | EMEP/CORINAIR, 2013 ¹ , IPCC, 2006 |
| | N ₂ O, NO– direct emission | 8.4.2 | Bouwman et al., 2002 ² |
| | N ₂ O –indirect emission | 8.4.3 | IPCC, 2006 ³ |
| Emission in water | Nitrates | 8.4.4 | IPCC, 2006 |
| | Phosphorus | 8.4.5 | Prahsun, 2006 ⁴ |

Sources of the emission factors proposed in the paragraphs from 4.3.2.1 to 4.3.2.5.

4.3.2.1. AMMONIA

Ammonia volatilized shall be estimated using the EMEP/CORINAIR emission factors.

| Fertilizers type | Emission factor | |
|----------------------------------|-----------------|--------------|
| | Low soil pH | High soil pH |
| Ammonium nitrate (AN) | 0.037 | |
| Anhydrous ammonia | 0.011 | |
| Ammonium phosphate (MAP and DAP) | 0.113 | 0.293 |
| Ammonium sulphate (AS) | 0.013 | 0.270 |
| Calcium ammonium nitrate (CAN) | 0.022 | |
| Calcium nitrate (CN) | 0.009 | |
| Ammonium solutions (AN) | 0.037 | |
| Ammonium solutions (Urea AN) | 0.125 | |
| Urea ammonium sulphate (UAS) | 0.195 | |
| Urea | 0.243 | |
| Other NK and NPK | 0.037 | |
| Animal manure ⁵ | 0,2 | |

Total NH₃ emissions from cultures due to fertilizer volatilization. Values are kg NH₃-N volatilized per kg of N in fertilizers applied

¹ EMEP/EEA air pollutant emission inventory guidebook - 2013

² Bouwman, A. F., L. J. M. Boumans, and N. H. Batjes, 2002, Modeling global annual N₂O and NO emissions from fertilized field

³ IPCC, 2006. Guidelines for National Greenhouse Gas Inventories

⁴ Prahsun V., 2006. Erfassung der PO₄-Austrage für die Okobilanzierung SALCA Phosphor. Agroscope Reckenholz – Tanikon ART, 20p

⁵ Source: IPCC, 2006. Indirect N₂O emissions from agriculture

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4.3.2.2. DIRECT EMISSION OF N₂O AND NO

N₂O and NO direct emissions shall be estimated using the emission factors calculated by Bouwman (2002).

| Fertilizers type | Emission factor N ₂ O | Emission factor NO |
|-------------------------------|----------------------------------|--------------------|
| Ammonium sulfate | 0,010 | 0,007 |
| Urea | 0,011 | 0,007 |
| Ammonium nitrate | 0,008 | 0,006 |
| Calcium ammonium nitrate | 0,007 | 0,006 |
| Ammonia, direct application | 0,009 | 0,005 |
| Nitrogen solutions | 0,010 | 0,007 |
| Other straight N | 0,012 | 0,010 |
| Ammonium phosphates | 0,009 | 0,007 |
| Other compound NP-N | 0,009 | 0,006 |
| Compound NK-N | 0,009 | 0,008 |
| Compound NPK-N | 0,008 | 0,006 |
| Generic mineral N fertilizers | 0,010 | 0,007 |
| Animal manure | 0,008 | 0,005 |

Total N₂O emissions from cultures due to fertilizer use. Values are kg N₂O-N and NO-N emitted per kg of N in fertilizers applied

4.3.2.3. INDIRECT EMISSION OF N₂O

Indirect emissions of N₂O shall be estimated using the emission factors proposed by the IPCC.

| | Emission factor N ₂ O indirect emission |
|---|--|
| per kg of NH ₃ -N volatilized from fertilizers applied | 0,01 |
| per kg of NO ₃ ⁻ -N lost by leaching/runoff | 0,0075 |

Total N₂O emissions from cultures due to fertilizer volatilization. Values are kg N₂O-N emitted per kg of NH₃-N volatilized from fertilizers applied and per kg of NO₃⁻-N lost by leaching/runoff

4.3.2.4. EMISSION OF NITRATES

Nitrates leaching and runoff shall be estimated using the most accurate methodology available. If more accurate methodologies cannot be used, they can be estimated using the emission factor proposed by the IPCC.

| | Emission factor NO ₃ ⁻ indirect emission |
|------------------------------------|--|
| per kg of N in fertilizers applied | 0,3 |

Total NO₃⁻ emissions due to leaching and runoff. Values are kg NO₃⁻-N emitted per kg of N in fertilizers applied

4.3.2.5. EMISSION OF PHOSPHORUS

We distinguish three different kinds of phosphorus emission to water:

- **leaching** of soluble phosphate to ground water (inventoried as “phosphate, to ground water”),
- **run-off** of soluble phosphate to surface water (inventoried as “phosphate, to river”);
- **erosion** of soil particles containing phosphorus (inventoried as “phosphorus, to river”)

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Phosphorus **leaching** to the ground water shall be estimated as an average leaching, corrected by phosphorus fertilization:

$$P_{gw} = P_{gwl} * F_{gw}$$

P_{gw} = quantity of phosphorus leached to ground water (kg/ha)

P_{gwl} = average quantity of P leached to ground water for a land use category (0,07 kg P/ha for arable land)

F_{gw} = correction factor for fertilization with slurry

$$F_{gw} = 1 + 0,2/80 * P_{2O_{5sl}}$$

$P_{2O_{5sl}}$ = quantity of P_{2O_5} applied

Run-off to surface waters shall be calculated in a similar way to leaching to ground water:

$$P_{ro} = P_{rol} * F_{ro}$$

P_{ro} = quantity of phosphorus lost through run-off to rivers (kg/ha)

P_{rol} = average quantity of P lost through run-off to rivers for a land use category (0,175 kg P/ha for arable land)

F_{ro} = correction factor for fertilization with phosphorus, calculated as:

$$F_{ro} = 1 + 0,2/80 * P_{2O_{5min}} + 0,7/80 * P_{2O_{5sl}} + 0,4/80 * P_{2O_{5man}}$$

$P_{2O_{5min}}$ = quantity of P_{2O_5} applied with mineral fertilizers (kg/ha)

$P_{2O_{5s}}$ = quantity of P_{2O_5} applied with slurry (kg/ha)

$P_{2O_{5man}}$ = quantity of P_{2O_5} applied with solid manure (kg/ha)

Phosphorus emissions through **erosion** to surface waters, if there is no more accurate information available, could be estimated using the default value **0.53 kg P_{2O_5} /ha**, derived from an elaboration made using the SALCA-P model (considering 1,5 t*ha⁻¹*yr⁻¹ of eroded soil).

4.3.2.6. ACTIVE SUBSTANCE OF PESTICIDES

To calculate the impact of pesticides production the content in active substance of the specific products shall be considered.

If no specific data are available, it shall be assumed that all pesticides applied are 100% emitted to agricultural soil.

Any deviation from these rules must be declared in the LCA and in the EPD

4.3.3 DOWNSTREAM PROCESSES

The following requirements apply to the downstream processes:

- The downstream module shall be based on relevant scenarios for the geographical area in which the EPD® is valid.
- Transport of the product to customer shall, as a first option be based on the actual transportation distances. As a second option, it could be calculated as the average distance of a product of that product type transported with different means of transport or, if also such data is not available be calculated as a fixed long transport, e.g. 1 000 km distance transport with lorry or 10 000 km by airplane, according to product type. With regard to data quality requirements for the end-of-life stage based on scenarios, the following shall apply for the information being:
 - technically and economically practicable, and
 - compliant with current regulations in the relevant geographical area.

Key assumptions regarding the end-of-life stage shall be documented.

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4.4 REQUIREMENTS REGARDING ALLOCATION FOR MULTIFUNCTIONAL PRODUCTS AND MULTIPRODUCT PROCESSES

An allocation problem occurs when a process results in multiple output products and where there is only aggregate information available about the emissions. The priorities suggested by ISO 14040 shall be considered in the procedure definition, however, the method of avoiding allocation by expanding the system boundaries is not applicable within the framework of the International EPD® System due to the rationale of the book-keeping LCA approach (attributorial LCA) used and the concept of modularity.

4.4.1 ALLOCATION FOR CULTIVATION

If straw (or a product comparable to straw) is harvested and sold as a byproduct, allocation between main products and straw shall be done using an economic method. The allocation factors proposed in the Ecoinvent database⁶ and reported in Table 1 could be used.

| Crop | Production system | % allocated to grains | % allocated to straw |
|--------|-----------------------|-----------------------|----------------------|
| Wheat | Extensive | 92,5 | 7,5 |
| | Integrated production | 92,5 | 7,5 |
| | Organic | 93,1 | 6,9 |
| Rye | Extensive | 90,3 | 9,7 |
| | Integrated production | 90,3 | 9,7 |
| | Organic | 91,9 | 8,1 |
| Barley | Extensive | 89,9 | 10,1 |
| | Integrated production | 89,9 | 10,1 |
| | Organic | 91,3 | 8,7 |

Allocation factors proposed in the Ecoinvent database.

4.4.2 ALLOCATION FOR OTHER PROCESSES

The following decision-hierarchy shall be applied for multifunctional products and multiproduct processes other than cultivation:

1. Allocation shall be avoided by dividing the unit process into two or more sub-processes and collecting the environmental data related to these sub-processes.
2. If not possible, 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 not possible, economic allocation is suggested.

4.5 REQUIREMENTS REGARDING ALLOCATION PROCEDURES FOR REUSE, RECYCLING

In the framework of the International EPD® System, the methodological choices for allocation for reuse, recycling have been set according to the polluter pays principle (PPP).

⁶ Nemecek T., Kagi Thomas, 2007. Life Cycle Inventories of Agricultural Production Systems. Ecoinvent report No.15

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If there is an inflow of recycled material to the production system, the recycling process and the transportation from the recycling process to where the material is used shall be included. If there is an outflow of material to recycling, the transportation of the material to the recycling process shall be included. The material going to recycling is then an outflow from the production system as an indicator.

For further information about system boundaries concerning waste, etc., see the General Programme Instructions of the International EPD® System.

4.6 REQUIREMENTS REGARDING ALLOCATION PROCEDURE FOR WASTE HANDLING

The treatment processes (final disposal) of wastes generated by the activities included in the system boundaries should be included in the LCA calculation. When it is not possible for some reasons (such as database framework or lack of information), the amount of wastes and the destination shall be declared.

For the purposes of the EPD® preparation, the final disposal processes include:

- landfilling that has to be attributed to the studied process,
- incineration. For the calculation of impacts related to incineration with energy recovery the environmental impact of waste destruction shall be attributed to the waste generator and the impacts related to making use of the thermal energy shall be attributed to the next product life cycle. If data are missing, as a default option, 50% of the impacts of the waste incineration plant may be attributed to waste treatment and 50% to the energy recovery. In case of incineration without energy recovery, the product system generating the waste must include 100% of the environmental impacts from incineration.

In case that waste flows are sent to material recycling or energy recovery or other recovery (e.g. composting), impacts should be borne by the product under study until it enters the facility gate where the recycling or recovery processes take place (e.g. transportation to the facility shall be included). Even if benefits related to the material recovery have to be considered out of the system boundaries, an estimation of the avoided impacts due to such recovery could be made and declared separately as additional environmental information. Deviations may be accepted and declared. All the assumption on the inclusion or not of waste treatment processes shall be clearly declared in the EPD.

For further information about system boundaries concerning waste, etc., see the General Programme Instructions of the International EPD® System.

5 LIFE CYCLE IMPACT ASSESSMENT

5.1 IMPACT INDICATORS

The following potential environmental impacts shall be calculated and reported in the EPD®:

- Emission of greenhouse gases (expressed as the sum of global warming potential, GWP, 100 years, in carbon dioxide equivalents, CO₂ eq.),
- Emission of acidifying gases (expressed as the sum of acidifying potential in sulphur dioxide equivalents, SO₂ eq.)⁷,
- Emission of substances to water contributing to oxygen depletion, “eutrophication” (expressed as phosphate equivalents, PO₄³⁻ eq.),
- Emission of gases that contribute to the creation of ground-level ozone, “photochemical oxygen creation potential” (expressed as the sum of ozone-creating potential, in ethylene equivalents, C₂H₄ eq.)

⁷ Please note that for this indicator a CML non-baseline approach is currently recommended. See www.environdec.com for the latest information.

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The characterisation models and factors to use for the default impact categories are available on the website www.environdec.com and are updated on a regular basis based on the latest development in LCA methodology and ensuring market stability of EPDs. The source and version of the characterisation models and factors used shall be reported in the EPD.

Alternative regional LCIA methods with other characterization factors are allowed to be calculated and displayed in addition to the default characterisation factors. The EPD® shall contain a clear explanation to what the difference is between the different sets of indicators, as they may appear to a non-expert to display duplicate information regarding the same environmental impact category. The EPD® or its supplementary materials may provide information about the different environmental impact categories displayed in the EPD, including their global/regional characteristics.

Some additional optional indicators that could be included in the LCA report and in the EPD are reported in the following paragraphs.

5.1.1 MARINE WATER EUTROPHICATION

This indicator is measured in g N eq. and represents the impact related to eutrophication due to nitrogen and phosphorus emissions in water.

The method suggested for the indicator calculation is ReciPe⁸

5.1.2 AQUATIC ECOTOXICITY

This indicator is measured in Comparative Toxic Unit (CTU) and refers to the impact of toxic substances (chemical and physical agents) on aquatic ecosystems. The impact is obtained by three characterisation factors:

- the fate factor, representing the persistence of a chemical in the environment,
- the exposure factor, representing the bioavailability of a chemical (fraction of the chemical dissolved)
- the effect factor, reflecting the change in the potentially affected fraction of species due to change in concentration

The method suggested for the calculation of the indicator is USEtox⁹ (<http://www.usetox.org/>).

5.1.3 LAND USE

This indicator is measured mass of C deficit. and represents the impact related to the use of soil.

The method suggested for the indicator calculation is Milà i Canals et al., 2007¹⁰. This method considers Soil Organic Matter (SOM) as a soil quality indicator. SOM is qualified as a keystone soil quality indicator, especially for assessing the impacts on fertile land use (agriculture and forestry systems). It influences properties like buffer capacity, soil structure and fertility.

5.1.4 WATER RESOURCE DEPLETION

This indicator is measured in volume of water and It relates water use to local scarcity of water. This enables differentiation between situations where water extraction causes different levels of impact.

⁸ ReCiPe main Report: Goedkoop M., Heijungs R., Huijbregts M., De Schryver A., Struijs J., Van Zel R., "ReCiPe 2008 A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and endpoint level – Report I: Characterisation", Ruimte en Milieu Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer, July 2012.

⁹ User manual: Huijbregts M., Hauschild M., Jolliet O., Margni M., McKone T., Rosenbaum R.K., Van de Meent D., "USEtoxTM User manual"; February 2010.

¹⁰ Milà i Canals L, Romanya J, Cowell SJ (2007b). Method for assessing impacts on life support functions (LSF) related to the use of 'fertile land' in Life Cycle Assessment (LCA). J Clean Prod 15 1426-1440

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The method suggested for the indicator calculation is Frischknecht et al., 2008¹¹.

5.2 IMPACT INDICATOR SELECTION JUSTIFICATION

The four default impact categories have been included as they constitute the minimum set of indicators for EPDs of all product categories in the International EPD® System.

6 LCA RESULTS

6.1 RESULTS

LCA results to be reported in the EPD® are:

- Use of resources
- Potential environmental impacts
- Waste production
- Other environmental indicators

6.1.1 USE OF RESOURCES

The use of resources shall be presented in the EPD® using results from the life cycle inventory. Resources are the elementary flows crossing the system boundary between nature and the studied product system.

The indicators for resource use from the life cycle inventory (except water and air) should be reported under the following headings per functional unit or per declared unit:

- Non-renewable resources
 - Material resources
 - Energy resources
- Renewable resources
 - Material resources
 - Energy resources

NOTE Energy resources are those resources that are used for energy conversion purposes in the product system.

The following requirements on the resource declaration also apply:

- all parameters for resource consumption shall be expressed in mass, with the exception of renewable energy resources used for the generation of hydroelectric, wind electricity and solar energy, which shall be expressed in MJ. Other resources may in addition to mass be expressed in MJ, if it increases understanding of the target audience of the EPD;
- all parameters shall not be aggregated but reported separately. Resources that contribute to less than 5% in each category shall be included in the resources list as "other" under each category;
- nuclear power shall be reported among the non-renewable energy resources as kg of natural uranium and primary energy demand in (MJ);

¹¹ Frischknecht R, Steiner R, & Jungbluth N, The Ecological Scarcity Method – EcoFactors (2006b): A method for impact assessment in LCA. 2009, Federal Office for the Environment FOEN: Zürich und Bern.

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- energy content of biomass used for feed or food purposes shall not be considered;

Water resource use indicators shall also be calculated from the elementary flows in the life cycle inventory. These indicators do not constitute a “water footprint” as potential environmental impacts due to the water use in different geographical locations is not captured. The minimum indicators for water resource use in the EPD® shall be:

- Water resource use:
 - Total water resource use
 - Direct amount of water used by the core process

The following requirements for the water resource use indicators apply (in part adopted from water footprint inventory in ISO 14046 Environmental management - Water footprint - Principles, requirements and guidelines):

- Water use includes evaporation, transpiration, product integration, release into different drainage basins or the sea, displacement of water from one water resource type to another water resource type within a drainage basin (e.g. from groundwater to surface water). In-stream water use is not included.
- For water used in closed loop processes (such as cooling system) and in power generation only the net water consumption (such as reintegrations of water losses) should be considered.
- Sea water shall not be included in the indicator.
- Tap water or treated water (e.g. from a water treatment plant), or waste water that is not directly released in the environment (e.g. sent to a wastewater treatment plant) are not elementary water flows, but intermediate flows from a process within the technosphere.
- Additional transparency in terms of geographical location, type of water resource (e.g. groundwater, surface water), water quality and temporal aspects are voluntary.

Besides the use of primary resources, the life cycle inventory results will also contain flows from the technosphere (i.e. from other product systems) when using the attributional LCA approach in Annex A. As these flows do not carry any upstream environmental burden, they shall be reported under the following heading for transparency and completeness:

- Secondary resources:
 - Material resources
 - Energy resources
 - Recovered energy flows, in MJ

NOTE Energy resources are those resources that are used for energy conversion purposes in the product system. Recovered energy flows are flows, such as thermal energy, from other upstream product life cycles, where the previous life cycle carries all the environmental burden of the generation of the energy flow.

6.1.2 POTENTIAL ENVIRONMENTAL IMPACTS

See Section 5.1.

6.1.3 WASTE PRODUCTION

Waste generated along the whole life cycle of the product shall be handled following the technical specifications described in the General Programme Instructions. When the amount of waste has to be declared, the following information shall be reported:

- Non-hazardous waste (kg),
- Hazardous waste (kg),
- Radioactive waste (kg).

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6.1.4 OTHER ENVIRONMENTAL INDICATORS

The following indicators per declared unit shall be reported in the EPD, divided into core, upstream and downstream module:

- the energy content into some products (such paper or plastic based products) is useful information for the end-of-life management. For this reason the “energy content of product” shall be declared in MJ: its estimation shall be made considering the gross calorific value of the product. Only the energy that is suitable for an eventual energy recovery at the end-of-life shall be considered (energy content of steel due to its carbon content for example shall not be considered since it is not practically recoverable);

6.1.5 UNITS AND QUANTITIES

The International System of Units (SI units) shall be used. Reasonable multiples may be adopted for a better understanding.

A maximum of three significant digits shall be used when reporting LCA results.

The thousands separator and decimal mark in the EPD[®] shall follow one of the following styles:

- SI style (French version): 1 234,56
- SI style (English version): 1 234.56

In case of any potential confusion, 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 Data elements and interchange formats – Information interchange – Representation of dates and times. For years, the prescribed format is YYYY-MM-DD, e.g. 2015-03-26 for March 26th, 2015.

6.2 INTERPRETATION

The LCA report underlying the EPD[®] should include, as a minimum, a sensitivity analysis of key parameters and a data quality assessment. The results do not have to be included in the EPD, but should be available to the verifier.

The General Programme Instructions recommend that the EPDs include an indicator suitable for demonstrate the share of specific data, selected generic data and proxy data for the environmental impacts.

6.3 ASSUMPTIONS AND LIMITATIONS

The LCA report underlying the EPD[®] should include key assumptions made and the limitations of the study. The results do not have to be included in the EPD, but should be available to the verifier.

6.4 UNCERTAINTY

The LCA report underlying the EPD[®] may include uncertainty assessment of the results. The results do not have to be included in the EPD, but should be available to the verifier.

7 INSTRUCTIONS FOR PRODUCING AND PROVIDING ADDITIONAL INFORMATION

7.1 PROGRAMME-RELATED INFORMATION

The EPD[®] shall include the following programme-related information:

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- Reference to the International EPD® System and to EPD International AB as the programme operator,
- Reference to www.environdec.com,
- The EPD® logotype,
- The reference PCR document upon which the EPD® is based identified according to registration number, date and CPC codes,
- Registration number (provided by the Secretariat),
- Date of publication and validity. The date of the latest revision should also be provided.
- Declaration of the year(s) covered by the data used for the LCA calculation and other relevant reference years. The main database(s) for generic data and LCA software used may be declared, if relevant,
- Geographical scope of application of the EPD®
- Reference to relevant websites for more information.

7.2 PRODUCT-RELATED INFORMATION

The EPD® shall include the following product and company-related information:

- Product identification by name, trade name and product code (if applicable),
- A simple visual representation or image of the product,
- Identification of the product according to the CPC classification system,
- Identification of the product according to other relevant codes for product classification (if appropriate), e.g. CPV code, the United Nations Standard Products and Services Code® (UNSPSC), Classification of Products by Activity (CPA) or Australian and New Zealand Standard Industrial Classification (ANZSIC),
- Name and contact information of the EPD® owner,
- Manufacturing site and country,
- Functional unit or declared unit,
- Short description of the underlying LCA-based information (e.g. summary of an existing LCA study or similar studies),
- Species and variety of the product, if relevant
- Production system (i.e. conventional or organic), if relevant,

In case of a Sector EPD®, the declaration shall also include the following product and company-related information:

- 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.
- A list of the contributing manufacturers

The following information is voluntary to include in the EPD:

- Technical description of the product in terms of functional characteristics, main product components and or materials, expected service life time etc.,
- Description of the intended use of the product,
- Manufacturers logotype,

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- Short description of the organisation, including information on product or management system related certifications (e.g. ISO 14024 Type I ecolabels, ISO 9001- and 14001-certificates and EMAS-registrations) and environmental policy,
- Other relevant work the organisation wants to communicate (e.g. SA 8000, supply-chain management and social responsibility),

Any claims made about the product must be verifiable.

7.3 CONTENT DECLARATION

The content declaration shall have the form of a list of materials and chemical substances including information on their environmental and hazardous properties. The gross weight of material shall be declared in the EPD® at a minimum of 99 % of one unit of product.

7.4 ADDITIONAL INFORMATION

Additional environmental information may be added in the EPD. Additional information is such information that is not derived from the LCA, LCI or information modules, but relevant to include in the EPD®, e.g. impact on biodiversity, impact on health, technical life length, maintenance, the final use of product, hazard and risk assessment, preferred waste management option for used products, etc.

7.5 MANDATORY STATEMENTS

The following information is mandatory to include in the EPD:

- Differences versus previous versions of the EPD
- Any omission of life cycle stages not making the EPD® cover the full life cycle, with a justification of the omission,
- Means of obtaining explanatory materials, for example references to chosen methodologies,
- A statement that “EPDs within the same product category but from different programmes may not be comparable”.

The EPD® shall also give the following information about the verification process:

| |
|---|
| Product category rules (PCR): PCR 2013:05 Arable crops, version 2.01 |
| Product Category Rules (PCR) review was conducted by: The Technical Committee of the International EPD® System. Review chair: Maurizio Fieschi Contact via info@environdec.com . |
| Independent verification of the declaration and data, according to ISO 14025:2006: <input type="checkbox"/> EPD process certification (internal) <input type="checkbox"/> EPD verification (external) |
| Third party verifier: <i>Name of the third party verifier (accredited certification body or approved individual verifier)</i> Accredited by: <i>Name of the accreditation body. For individual verifiers, the text shall be: “Approved by the International EPD® System”</i> |

7.6 REFERENCES

The EPD® shall, if relevant, refer to:

- The underlying LCA
- The name, CPC code and version number of the PCR used

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- Other documents that verify and complement the EPD®
- Instruction for recycling, if relevant
- The General Programme instructions of the International EPD® System

8 GLOSSARY

| | |
|-----------------|--|
| CO ₂ | Carbon dioxide |
| CPC | Central product classification |
| EPD | Environmental product declaration |
| ISO | International Organization for Standardization |
| kg | kilogram |
| LCA | Life cycle assessment |
| PCR | Product Category Rules |
| SI | The International System of Units |
| SO ₂ | Sulphur dioxide |
| UN | United Nations |

9 REFERENCE LITERATURE

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

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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 (2007), ISO 21930:2007, Sustainability in building construction -- Environmental declaration of building products

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

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IPCC, 2006. Guidelines for National Greenhouse Gas Inventories

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10 VERSION HISTORY OF PCR

VERSION 1.0, 2013-06-12

First publication

VERSION 1.01, 2014-02-21

Minor changes by the Secretariat without any impact on the technical aspects or methodological guidance:

- Information added to cover page
- Information added to General Information
- General introduction changed to latest version
- Minor editorial changes

VERSION 2.0, 2016-06-23

- Use of the latest PCR Basic Module (CPC Division 01: Products of agriculture, horticulture and market gardening, version 2.5, dated 2015-12-22)
- Water Footprint and Ecological Footprint have been removed from the additional indicators, because the use of such aggregate indicators could be misleading when interpreting the environmental performance.
- The indicators Water resource depletion and Land use have been added

VERSION 2.01, 2020-11-16

- Extension of the validity of the PCR until 2020-12-15, when an updated version (version 3.0) is expected to be available, in line with Section 5.5.2.1 of the GPI.

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APPENDIX A: CONTENT OF EPD®

As a general rule the EPD® content shall be in line with the requirements and guidelines in ISO 14020 and:

- must be verifiable;
- must not include rating, judgements or direct comparison with other products.

This requirement applies also to images in the EPD as pictures, especially on the cover page, could in themselves be interpreted as an environmental claim. Images such as trees, mountains, wildlife that are not related to the declared products should be used with caution and in compliance with national legislation and best available practices in the markets in which it will be used.

EPD®s can be published on several languages, but if the EPD® document is not available in English, the organisation shall provide a summary in English including the main content of the EPD® to be available on www.environdec.com.

The EPD® cover page (if existent) shall as a minimum include relevant information about the product, such as name and an image, the EPD® logotype and date of publication and validity.

The EPD® shall contain the following parts:

- Cover page (voluntary)
- Programme-related information
- Product-related information
- Content declaration
- Environmental performance-related information
 - Use of resources
 - Potential environmental impacts
 - Waste production
 - Other environmental indicators
- Additional environmental information
- Mandatory statements
- References
- Executive summary in English (in case the full EPD® is only published in another language)

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