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Product Category Rules for North American Market Pulp, Paper and Paperboard Products, Tissue, and Containerboard

FPInnovations - PCR 2017

UN CPC 32: Pulp, paper and paper products; printed matter and related articles

This PCR document is valid for five (5) years from the date of issue.

This PCR-document has been developed in accordance with FPInnovations' General Program Instructions (March 2013 Version)

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List of Abbreviations

ASTM	American Society for Testing and Materials
B2B	Business to business
CFC	Chlorofluorocarbon
CPC	Central Product Classification
DQA	Data quality assessment
EPD	Environmental Product Declaration
FU	Functional unit
GWP	Global warming potential
HHV	Higher heating value
HW	Hardwood
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life cycle inventory analysis
LCIA	Life cycle impact assessment
NPRI	National Pollutant Release Inventory
NCASI	National Council for Air and Stream Improvement
PCR	Product Category Rules
SW	Soft Wood
TAPPI	Technical Association of the Pulp and Paper Industry
TMP	Thermo-mechanical pulp
TRACI	Tool for the Reduction and Assessment of Chemical and other environmental Impacts
TRI	Toxics Release Inventory
US EPA	United States Environmental Protection Agency

1 General Information

The primary objective of Product Category Rules (PCR) is to provide the rules and requirements for conducting life cycle assessment (LCA) project reports and developing environmental product declarations (EPDs) for certain product categories. The aim of this PCR document is to provide detailed guidelines for conducting LCA project reports and producing Type III EPDs for the broad group of paper related products stated under the UN CPC Division 32. The main PCR contains general guidance for producing and publishing an EPD. Guidelines specific to the relevant classes and subclasses can be found in the PCR modules mentioned below.

- *PCR Module 1: CPC 3211 Pulps of wood or other fibrous cellulosic material - Subclasses 32112 and 32113*
- *PCR Module 2: CPC 32129 Uncoated paper and paperboard, of a kind used for writing, printing or other graphic purposes, and CPC 32143 Paper and paperboard coated with kaolin or with other inorganic substances*
- *PCR Module 3: CPC 32131 Toilet or facial tissue stock, towel or napkin stock and similar paper, cellulose wadding and webs of cellulose fibers*
- *PCR Module 4: CPC 32151 – Corrugated paper and paperboard. This product is referred to as containerboard in North America.*

The PCR document has been developed under the FPInnovations' general program instructions (March 2013 version) released on April 1, 2013 for its EPD program. An EPD is a verified document registered by an EPD program operator.

The primary users of this PCR document are North American market pulp, paper and paperboard products, tissue, and containerboard manufacturers. Publication of EPDs produced using this PCR document shall be done in accordance with ISO 14025.

This PCR document conforms to the requirements contained within the following ISO standards:

- ISO 14025: 2006, Environmental labeling and declarations – Type III environmental declarations – Principles and procedures.
- ISO 14040: 2006, Environmental management – Life cycle assessment – Principles and framework.
- ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines

In the absence of a readily available existing ISO-conformant PCR document for North American paper and paperboard products, tissue, and containerboard, FPInnovations developed this PCR for the manufacturers of these products operating in North America to create and publish EPDs[1]. In order to

[1] Note that the wood and paper PCR developed by SCS Global Services and North American Environmental Paper Network (see https://www.scsglobalservices.com/pcr-for-roundwood-and-pulppaper) was not considered as a readily available PCR to adapt for the following reasons:

- The application of the impact assessment method provided in this PCR has not been tested for scientific accuracy and validity, and results have never been published in a scientific journal,
- Rationale, practicality, and scientific and technical validity of the guidelines have been questioned by LCA subject matter experts,
- The technical committee is missing several key stakeholders, including North American wood, pulp and paper manufacturers.

harmonize with the existing ISO compliant PCRs for pulp and a variety of end products manufactured from pulp, the European PCR module for Pulp, Paper and Paper Products; Printed Matter and Related Articles (Version 1.1 dated 2011-02-28) and Tissue Products PCR (PCR 2011:05 Version 1.0 dated 2011-05-24) published by the International EPD® System were used as a template to develop this PCR document. That PCR module and the tissue products PCR were not in a readily available form to be used to create EPDs for market pulp produced in North America. The reasons for the modifications done to the European PCR module and the tissue products PCR in developing this new PCR document are stated below.

Reasons for Differences and Modifications from European PCR:

- Focuses specifically on market pulp, paper and paperboard products, tissue, and containerboard production, and associated upstream and core processes;
- Changes in terminology to be consistent with North American language;
- Uses more rigorous cut-off rules based on the LCA studies on which this PCR document is based;[2]
- Allows the use of the Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI) system that contains characterization factors for North American LCA; and
- Provides clarity regarding approach to biogenic carbon emissions accounting in the global warming potential (GWP) impact category.

This PCR document provides a set of specific rules, requirements and guidelines for developing EPDs for market pulp, paper and paper products, tissue, and containerboard manufactured in North America and provides requirements for EPDs developed for Business-to-Business (B2B) communication. Market pulp types differ due to differences in quality and other physical properties, and have different applications. All paper grades are not functionally equivalent due to differences in quality. EPDs based on the PCR document cannot be used to compare within pulp types or paper grades for this reason.

2 Referenced Documents

ISO Conformant LCA Reports on the Life Cycle Assessment of North American market pulp, paper and paper products, tissue, and corrugated products manufactured in North America.

- Ingwersen, W., Gausman M., Weisbrod A., Sengupta D., Lee S., Bare J., Zanoli E., Bhander G., and Ceja, M., 2016. Detailed life cycle assessment of Bounty® paper towel operations in the United States. J Clean Prod, 131: 509-522.
- NCASI, 2010. Life Cycle Assessment of North American Printing and Writing Paper Products. Report Prepared for American Forest and Paper Association (AF&PA) and Forest Products Association of Canada (FPAC).
- NCASI, 2010. Life Cycle Assessment North American Unbleached Grocery Bags. Report Prepared for American Forest and Paper Association (AF&PA) and Forest Products Association of Canada (FPAC).

[2] NCASI, 2010. Life Cycle Assessment of North American Printing and Writing Paper Products. North Carolina, USA.
NCASI, 2010. Life Cycle Assessment of North American Unbleached Grocery Bags. North Carolina, USA.
NCASI, 2014. Life Cycle Assessment of U.S. Average Corrugated Product. North Carolina, USA.
PE Americas, 2010. Life Cycle Assessment of U.S. Industry Average Kraft Paperboard Products. Boston, USA.

- NCASI, 2014. LCA Report on the Life Cycle Assessment of U.S. Average Corrugated Product. Report Prepared for Corrugated Packaging Alliance.
- PE Americas, 2010. Life Cycle Assessment of U.S. Industry Average Kraft Paperboard Products. Report Prepared for Paperboard Packaging Alliance.

Other Reports and Papers:

- Côte´, W., Young, R.J., Risse, K.B., Costanza, A.F, Tonellia, J.P, and Lenocker C., 2002. A carbon balance method for paper and wood products. *Environmental Pollution* 116: P. S1–S6.
- Edelen, A. and Ingwersen, W., 2016. Guidance on Data Quality Assessment for Life Cycle Inventory Data. National Risk Management Research Laboratory, Office of Research and Development, US EPA, Ohio, USA.
- Miner, R. and Upton, B. 2002. Methods for Estimating Greenhouse Gas Emissions from Lime Kilns at Kraft Pulp Mills. *Energy* 27(8):729-738.
- UNEP, 2016. Global Guidance for Life Cycle Impact Assessment Indicators, Volume 1. Life Cycle Initiative.

Existing PCRs and draft PCRs:

- PCRs modules: Pulp, Paper and Paper Products; Printed Matter and Related Articles (Version 2 dated 2013-10-24), a template published by the International EPD® System for developing PCRs.
- Tissue Products (PCR 2011:05 Version 1.0 dated 2011-05-24) published by the International EPD® System.
- Product Category Rules (2010:17 Version 2.1): Containers of paper and paperboard, except beverage cartons (UN CPC 32153) published by the International EPD® System.

ISO Standards:

- ISO 14001:2004, Environmental management systems -- Requirements with guidance for use.
- ISO 14020: 2000, Environmental labels and declarations -- General principles.
- ISO 14024:1999, Environmental labels and declarations -- Type I environmental labelling -- Principles and procedures.
- ISO 14025:2006, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.
- ISO 14040:2006, Environmental Management - Life Cycle Assessment - Principles and Framework.
- ISO 14044:2006, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
- ISO 14046:2014, Environmental management - Water footprint - Principles, requirements and guidelines.
- ISO/TR 14047:2012, Environmental management -- Life cycle assessment -- Illustrative examples on how to apply ISO 14044 to impact assessment situations.
- ISO 2470-1:2009, Paper, board and pulps -- Measurement of diffuse blue reflectance factor -- Part 1: Indoor daylight conditions (ISO brightness).
- ISO/TR 14049:2012, Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis.
- ISO 14050:2009, Environmental management - Vocabulary.
- ISO 21930:2007, Sustainability in building construction- Environmental Declaration of building products.

Other Relevant Documents:

- Product Category Rules for North American Structural and Architectural Wood Products, 2015. FPInnovations. https://fpinnovations.ca/
- Product Category Rule Development Initiative, 2013. Guidance for Product Category Rule Development. http://www.pcrguidance.org/.
- Manfredi S., Allacker K., Chomkhamsri, K., Pelletier, N., Maia de Souza, D., 2012. Product Environmental Footprint Guide. European Commission, Joint Research Centre, and Institute for Environment and Sustainability.
- TAPPI T 452. Brightness of pulp, paper, and paperboard (directional reflectance at 457 nm).
- TAPPI T 525, Diffuse brightness of paper, paperboard and pulp (d/0) – ultraviolet level C.

3 Terms and Definitions

For the purposes of this document, the definitions given in ISO 14025, ISO 14044, ISO 14050, ISO 21930 and the following apply.

Allocation
Partitioning the environmental flows (input and output flows) of a process or a product system between the product system under study and one or more other product systems (adapted from ISO 14044).

Ancillary material
Material input that is used by the unit process producing the product or during the construction or use stage, but does not constitute part of the product (adapted from ISO 14044).

Brightness
Diffusive reflectance of blue light from a pad of pulp sheets from light having a wave length of 457 nm. Brightness can be reported using the TAPPI T 452 or T 525 standards or ISO 2470-1:2009 standard (ISO brightness).

Core module
The portion of the life cycle pertaining to the production of the final product.

Characterization factor
Factor derived from a characterization model which is applied to convert an assigned life cycle inventory analysis (LCI) result to the common unit of the impact category indicator (adapted from ISO 14044).

Cut-off criteria
Specification of the amount of material or energy flow or the level of environmental significance associated with unit processes of a product system to be excluded from a LCA study (adapted from ISO 14044).

Declared unit
Quantity of a product for use as a reference unit, e.g. mass (kilogram), volume (cubic metre), for the expression of environmental information needed in information modules (adapted from ISO 21930).
Note: The concept of declared unit, i.e., used in instances where the function and the reference scenario for the whole life cycle of a product cannot be stated, can be found only in ISO 21930 which specifically focuses on building products. The concept of declared unit is however deemed applicable to the other products as well, especially when a functional unit cannot be defined due to exclusion of the use phase.

Elementary flow
Material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation (adapted from ISO 14044).

Environmental aspect
Element of an organization's activities, products or services that can interact with the environment (adapted from ISO 14001:2004, definition 3.6).

Environmental declaration/label
A claim that indicates the environmental aspects of a product (adapted from ISO 14020:2000).

Feedstock energy
Heat of combustion of a material input that is not used as an energy source to a product system, expressed in terms of higher heating value (HHV) (adapted from ISO 14044). E.g. wood fiber entering pulp manufacturing contains HHV 18.7 -21.9 MJ/ kg.

Functional unit (FU)
Quantified performance of a product system for a product for use as a reference unit (adapted from ISO 14044).

Impact category
A class representing environmental issues of concern to which life cycle inventory analysis results may be assigned (ISO 14044).

Impact category indicator
A quantifiable representation of an impact category (ISO 14044).
(Note: The shorter expression “category indicator” is used in this PCR for improved readability.)

Information module
Compilation of data to be used as a basis for an EPD covering a unit process or a combination of unit processes that are part of the life cycle of a product (ISO14025).

Interested party
An individual or group concerned with or affected by the environmental performance of a product system, or by the results of the life cycle assessment (ISO 14044).

Life cycle
Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal (ISO 14044).

Life cycle assessment (LCA)
Assessment aimed at compiling and evaluating the inputs, outputs and the potential environmental impacts of a product system throughout the life cycle of a product (adapted from ISO 14044).

Life cycle inventory analysis (LCI)
Phase of LCA involving the compilation and quantification of environmental input and output flows for a product throughout its life cycle (ISO 14044).

Life cycle impact assessment (LCIA)
Phase of LCA aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product (ISO 14044).

Product category
Group of products that can fulfill equivalent functions (adapted from ISO 14025).

Product category rules (PCR)
Set of specific rules, requirements and guidelines for the development of type III environmental declarations for one or more product categories (ISO 14025).

PCR review
Verification of PCR by a third party panel (adapted from ISO 14025).

Product system
Collection of unit processes with elementary and product flows (i.e., smallest element considered in the life cycle inventory analysis), performing one or more defined functions, and which models the life cycle of a product (adapted from ISO 14044).

System boundary
A set of criteria that specifies which unit processes are part of a product system (adapted from ISO 14044).

Type I environmental label
A voluntary conformance to pre-determined, overall environmental preferability within a particular product category, based upon life cycle considerations. Type I labels are awarded by third-party environmental programs (ISO 14024).

Type II environmental label
Environmental claim that is made, without independent third-party certification, by manufacturers, importers, distributors, retailers or anyone else likely to benefit from such a claim (adapted from ISO 14021).

Type III environmental declaration/Environmental product declaration (EPD)
Environmental declaration that provides quantified environmental data of a product, using predetermined parameters and, where relevant, additional environmental information.

Upstream module
The portion of the life cycle pertaining to the production of raw materials and energy.

Water body
Water body is an entity of water with definite hydrological, hydrogeomorphological, physical, chemical and biological characteristics in a given geographical area e.g., lakes, rivers, groundwaters, seas, icebergs, glaciers and reservoirs (adapted from ISO 14046:2014, definition 3.1.7).

Water consumption
Water removed from, but not returned to, the same drainage basin. Water consumption can be because of evaporation, transpiration, integration into a product, or release into a different drainage basin or the sea (14046:2014(E)).

Water use
In this PCR, water use (or water withdrawal in ISO 14046) is defined as the anthropogenic removal of water from any water body or from any drainage basin, either permanently or temporarily ((ISO 14046:2014(E)).

4 Period of Validity of this Document

This document is valid until August, 2022 (5 years), if not superseded prior to that by an updated version.

5 Requirements for the Underlying LCA

5.1 Study Goals

Goal definition shall include the commissioner of the study, reasons for carrying out the study, target audience, intended applications and the review procedure.

5.2 Scope of the Study

Scope of the LCA shall be cradle-to-gate that includes all upstream process energy and material input production, input transportation to a production facility, product manufacturing and warehouse activities. Capital equipment and infrastructure, and human activities shall not be included in the system boundary.

See specific guidelines pertaining to the study scope of each of the product categories provided under the PCR modules below.

- Market pulp – PCR Module 1
- Paper and paperboard products – PCR Module 2
- Tissues – PCR Module 3
- Containerboard – PCR Module 4

5.3 Life Cycle Inventory Analysis

Geographical Boundaries
The data for the core module shall be representative of the actual production processes and applicable to the site/region in North America where the respective process is taking place.

Boundaries to Nature
Boundaries to nature include material and energy resources flows from nature into the system (ISO 14044 definition of elementary flows for boundaries with nature applies). Emissions to air, water and soil emitted from the product system crosses the system boundary when they leave the system.

Cut off Rules
Cut-offs should be avoided as much as possible by collecting process-specific data. In cases where there are no existing process-specific data available for a given process, estimates should be used based on a similar process (for example, hardwood pulp production could be estimated from softwood pulp production). If cut-off cannot be avoided, the following rules shall be applied:

1. When estimation is not possible, the flows or data contributing less than 1% of the mass or energy inputs can be excluded and the potential significance of these exclusions shall be assessed (qualitatively or quantitatively).
2. Environmental relevance – if a process flow or data meets the above criteria, but is determined to contribute 2% or more to the selected impact categories of the products underlying the EPD, it is included within the system boundary.

The cut-off rules do not apply to toxic materials and substances. The toxic materials and substances listed in Annex 1 shall be included in the LCA for other indicators and additional environmental information reporting described in Section 5.4 and Section 5.6 respectively. The fraction of mill's yearly reported amounts to the NPRI (National Pollution Release Inventory of Canada) or the TRI (Toxic Release Inventory Program of U.S.A.) applicable to the studied product can be used if no higher precision data is available. The mill's reported data can be derived from direct measurements or from suitable emission factors available from the U.S. EPA[3] or the National Council for Air and Stream Improvement (NCASI).

Allocation Rules

Co-Products

Environmental burden allocation among various co-products is best achieved by dividing unit processes into sub-processes if the sub-process input and output data can either be collected separately or reasonably estimated using mass balances, thermodynamics, and/or stoichiometry. Where allocation cannot be avoided, allocation of multi-output processes should be based on the physical composition of the outputs (i.e., mass allocation). Material inherent properties such as biogenic carbon, water, and energy content are allocated according to their physical flows, i.e., by mass.

Production waste

Cut-off approach should be applied. (the approach includes disposal but recycling. No credits should be given for material recycling or energy recovery.

Treatment of Recycled Fiber Inputs

EPDs developed using this PCR shall apply the cut-off method to recycled fiber inputs used in the production phase. Collection, sorting (if applicable) and transportation to where the material input is used shall be included.

The selection of the allocation method for recycling shall be consistent with the intended application of the EPD. The number of use method described in ISO 14049 is the only published method that reflects the complex interactions between virgin and recycled fiber and acknowledges the fact that wood fibers can be used multiple times. For this reason, it is more suitable for comparison of products with different recycled contents. However, to be applied appropriately, the number of use method require information on the end-of-life of the product, which is not available in cradle-to-gate studies and hence would require assumptions to be made, for instance using industry-average information. Environmental information using the number of uses method can be reported in "Additional Environmental Information". Assumptions should be documented.

If different allocation options for co-products and recycling are relevant to the product category under consideration and a deviation of greater than 20% is a foreseen outcome in any of the impact categories considered, a sensitivity analysis should be included in LCA. Allocation issues, different allocation approaches applied and data sets shall be documented and declared in the EPD.

[3] See http://www.epa.gov/ttnchie1/ap42/

Selection of Data

EPDs describe either average or brand specific product. The following rules apply for the selection of data for the calculation of EPDs:

- EPDs describing an average product – representative average data of the product shall be used to calculate the EPD.
- EPDs describing a specific product – at least specific process data from the producer of the specific product shall be used to calculate the EPD. Generic data may be used for the upstream and downstream processes, for example, raw material extraction and processing, electricity generation, waste incineration, etc. that the producer does not have any influence or control over.
- For generic data, North American data sources (e.g., U.S Life Cycle Inventory Database www.nrel.gov/lci, CORRIM, Athena Sustainable Material Institute or other databases that have country- or continent specific data such as ecoinvent or GaBi) can be used. Most recent data specific to the region shall be used to the extent that they are applicable. All data sources shall be specified, including database and year of publication (reference). Sources of data for transport models (including transport form, distances and quantities to be transported) and thermal energy production shall be documented.

Data collection

The data shall be representative according to temporal, geographical and technological requirements.

- **Temporal:** The obtained information from the manufacturing process should be annual approximate values and updated every five-year period. Average background data shall not be older than ten years unless accompanied by a statement attesting to the validity of older data.
- **Geographical**: The geographic region of the relevant upstream processes included in the calculation of representative data shall be documented.
- **Technological**: Data shall represent technology in use.

Any site-generated energy and purchased electricity shall be included in the system boundary. The extraction, processing and delivery of purchased primary fuels, e.g., natural gas and primary fuels used to generate purchased electricity, shall also be included within the boundaries of the system. Purchased electricity consumed at various site locations shall be modeled based on the breakdown of production technologies specific to the electricity grid in which the facility is located. For core modules for facilities that are located in the U.S., the modelled grid shall be based on the relevant eGRID[4] subregion and for Canadian facilities the province-specific electricity grid shall be modelled, unless it can be justified otherwise.

Units

SI units shall be used with conversions as shown in Table 1 as necessary and preferred power and energy units are as follows:

- kWh for electric energy
- kW for power

[4] https://www.epa.gov/sites/production/files/styles/large/public/2017-01/egrid2014_egrid_subregions.jpg

Table 1 Conversion factors to be used to convert IP units (Imperial) to SI units

Convert from	To	Multiply by
Square meter (m^2)	Square foot (ft^2)	1.0763E+01
Kilogram (kg)	Pound (lb)	2.204E+00
Mega joule (MJ)	British Thermal Unit (BTU)	9.47817E+02
Degree Celsius (°C)	Degree Fahrenheit (°F)	t/°C = (t/°F - 32)/1.8
Cubic meter (m^3)	Cubic foot (ft^3)	3.531E+01
Meter (m)	Foot (ft)	3.281E+00
m^2K/W	ft^2Fhr/Btu	5.678E+00

Source: NIST: http://physics.nist.gov/Pubs/SP811/appenB9.html

Data Quality Requirements
Procedure for data quality assessment stated in Annex 2 shall be applied when drawing secondary data. Any secondary data source used in the underlying life cycle inventory shall be complete within the cut-off limits and representative of the applicable North American region in terms of its geographic and technological coverage. The reference year of the dataset should be less than ten years old. Data should have been critically reviewed for accuracy, consistency and reproducibility. Any deviations from these initial data quality requirements for secondary data shall be documented.

5.4 Environmental Performance-Related Information

Use of Resources
The EPD shall report the consumption of natural resources per declared unit:
Non-renewable resources:

- Material resources – Unit: kg
- Energy resources (used for energy conversion purposes) on a higher heating value (HHV) basis – Unit: MJ
- Feedstock energy on a higher heating value (HHV) basis – Unit: MJ

Renewable resources:

- Material resources (wood fiber) – Unit: kg
- Energy resources (used for energy conversion purposes) on a higher heating value (HHV) basis – Unit: MJ
- Feedstock energy on a higher heating value (HHV) basis – Unit: MJ
- Water use and water consumption – unit: litres
  Water use shall be reported according to the water withdrawal definition provided in ISO 14046:2014(E). .Water consumption may also be reported in line with the guidelines stated in Annex 3.

Environmental Impacts
The environmental impacts per declared unit for the environmental impact categories mentioned below shall be reported in the EPD. A breakdown of impact category results by core and upstream modules discussed earlier shall also be provided:

- Global warming potential – emissions and removals of greenhouse gases (expressed in global warming potential (GWP) in 100 year perspective (kg of CO_2 equivalents)[5]
- Ozone-depletion potential (expressed as the sum of ozone-depleting substances in kg of CFC-11-equivalents, 20 years).
- Respiratory effects (expressed as the sum of substances causing respiratory effects in kg of PM2.5 basis).
- Acidification potential (expressed as the sum of acidification substances in terms of kg of SO_2 equivalents).
- Photochemical smog potential (expressed as the sum of ozone-creating substances in terms of kg of O_3 equivalents).
- Eutrophication potential (expressed as kg of N equivalents).

The above environmental impact categories shall be calculated based on US EPA TRACI (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts) LCIA method. Most recent version of TRACI and most recent IPCC factors apply. In addition, the users of this PCR document may report environmental impacts using other widely used impact assessment methods such as CML.

The carbon content of the product or the changes in carbon stocks from land use changes shall not be included under environmental performance-related information, but rather be reported under additional environmental information.

Other Indicators
The following indicators per declared unit shall be reported in the EPD:

- Recyclable materials (materials subject to recycling and need to be reported for the core processes only). Unit: kg
- Solid waste. Unit: kg
- Hazardous waste generated (as defined by regional directives and needs to be reported for the core processes only). Unit: kg
- Other waste generated (needs to be reported for the core processes only). Unit: kg
- Total emissions of the ten most important toxic chemicals in terms of their human carcinogenic potential, non-carcinogenic potential and ecotoxicity potential. Contribution to carcinogenic, non-carcinogenic and ecotoxicity potentials shall be calculated by applying the TRACI method. Unit: kg and CTU (Comparative Toxic Unit).

Land use impacts and human toxicity are excluded for the following reasons:

- Forests are a dynamic resource and subject to natural disturbances such as forest fires, disease and pest outbreaks. As a result, assigning land impacts compared to a static forest would indicate a certainty that does not exist. Land impacts can be negative or positive and there is no consensus within the scientific community on how to account for net impacts. Currently there is no internationally accepted methodology to address land use impacts on biodiversity and ecosystems services. United Nations Environment Program does not recommend its most recent impact assessment method for biodiversity for comparative assertions and product labelling (see UNEP, 2016).
- LCAs do not generally address toxic effects of products on human health.

[5] Calculated GWP does not include biogenic carbon emissions or removals and can be used as the starting point for estimating net biogenic carbon content of products described in Section 5.5.2.

5.5 Biogenic Carbon Considerations

5.5.1 Forest carbon stocks

The global warming indicator results reported under section 5.4 excludes biogenic CO_2. However, EPDs generated using these PCRs need biogenic CO_2 and removals to be reported under additional information (see section 5.6). For the purpose of this PCR, it is assumed that, because over a 10-year period[6] forest carbon stocks in North America have been stable or increasing (see detailed justification below), emissions of biogenic CO_2 are offset by an equivalent removal from the atmosphere, that is removals of CO_2 from the atmosphere attributable to the studied product are equivalent to the carbon content of the wood input to the system. However, in cases where the wood used in the studied product is derived from regions involving land use change (with positive or negative impacts on carbon stocks) and that land use change is attributable to the studied product, then the user of the PCR is encouraged to report the information as additional information (see section 5.6).

Forest carbon stocks in the U.S. have been shown to be increasing over the last 10 years (U.S. EPA, 2016, Inventory of GHG Sources and Sinks, 1990-2014, Report EPA 430-R-16-002). The increase in U.S. forest carbon stocks, in the face of a history of increasing wood production, can be attributed in part to the role of wood markets in providing an incentive to keep land in forest that might otherwise have been converted to other uses[7]. In Canada, natural disturbances cause forest carbon stocks to decline in some years, but averaged over multiple years, Canadian forest carbon stocks are essentially stable (Environment Canada, 2016, National Inventory Report 1990–2014: Greenhouse Gas Sources and Sinks in Canada). While considering the stable carbon stocks in the US and Canada, North America is defined as the region for biogenic carbon considerations. Consequently, net biogenic carbon emissions associated with forest biomass from North American forests can be presumed to be zero unless there are specific reasons to challenge this presumption, such as knowledge that wood is being produced by deforestation (discussed below). Another reason for assuming that wood produced under sustainable forest management programs is associated with net biogenic carbon emissions of zero is that these programs contain requirements to regenerate the forest, that reabsorb carbon emitted into the atmosphere [8].

Forests are natural systems with multiple functions, the production function of timber being one of them. The changes in forest carbon addressed in LCAs of wood and wood-derived products should be limited to those attributable to this timber production function. Natural growth, decay and disturbance processes unrelated to timber production are not included. As a result, this PCR allows biogenic carbon balances and estimates of net biogenic carbon emissions associated with North American roundwood, to exclude the effects of activities and disturbances unrelated to wood production.

[6] Based on the appropriations made by the US Senate for timberland carbon stock assessment.
[7] See Hardie et al. 2000. Responsiveness of rural and urban land uses to land rent determinants in the US South. *Land Econ*. 76:659–673. And Lubowski et al. 2008. What drives land-use change in the United States? A national analysis of landowner decisions. Land Econ. 84:529 –550.
[8] The American Forest Foundation, Standards of Sustainability contain an indicator requiring that "harvested forest land … achieve adequate stocking of desired species reflecting the landowner's objectives, within five years after harvest, or within a time interval as specified by applicable regulation. The Canadian Standards Association Sustainable Forest Management Standard requires participants to "reforest promptly and use tree species ecologically suited to the site." The FSC standard requires that "the rate of harvest of forest products … not exceed levels which can be permanently sustained." The SFI Standard, for instance, requires participants "…to provide for regeneration after harvest and maintain the productive capacity of the forestland base, and to protect and maintain long-term forest and soil productivity…".

Harvesting operations lead to temporal decreases in forest carbon pools in the respective stand. Impacts on forest carbon pools resulting from the sustainable or unsustainable management of forests, however, cannot be defined or assessed at the stand level. Instead, the assessment of impacts on forest carbon pools requires the consideration of carbon pool changes at regional level. A reasonable assumption, resulting from the fundamental principle of all sustainable forest management programs to preserve the production function of forest, is that total forest carbon pools can be considered stable (or increasing) under sustainable forest management. This is due to the fact that temporal decreases of forest carbon pools resulting from harvesting on one site are compensated by increases of carbon pools on other sites, forming together the forest area under sustainable forest management.

It is acknowledged that excessive extraction of slash, litter or roots for the purpose of bioenergy generation can lead to decreases in forest carbon pools. These activities, however, are not causally linked to the product addressed in this PCR, i.e., North American roundwood. Effects on forest carbon pools related to the extraction of slash, litter or roots are not attributable to the material use of roundwood and are therefore not considered in this document. However, it is understood that as long as regional forest carbon stocks are stable or increasing, all forest biomass from the region should be considered to be associated with net biogenic carbon emissions of zero.

In order to reflect the biogenic nature of wood, its renewability and net biogenic carbon emissions, the system boundary between nature and the product system under study is defined as follows:

- The energy and carbon in wood entering the product system are flows from nature and are material inherent properties.
- All technical processes related to forestry operations intended to produce timber, (e.g. stand establishment, nursery operations, tending, thinning(s), and harvesting) are considered within the system boundary and are subject to co-product allocations as outlined in Section 5.3.
- Potential implications due to the unknown origin of wood or unsustainably produced timber are considered.
- Human induced impacts on forest carbon pools resulting in deforestation or significant reductions in average regional forest carbon stocks are included.

As the degradation of forest carbon pools resulting from unsustainable management of forests cannot be attributed to a specific log but is a process on regional level, the effect of forest degradation is taken into account by rejecting the default assumption of zero net emissions of biogenic carbon. In the case of land-use changes from forests to other land uses (e.g., deforestation) or activities that result in significant reductions in average regional forest carbon stocks, the loss of carbon in the forest carbon pools are to be taken into account.

Care has to be taken that energy content and biogenic carbon content are allocated reflecting the physical flows, irrespective of the allocation chosen for the process. Carbon balance of the wood is due to its biogenic carbon content and carbon emissions or removals in the carbon stock (assumed to be zero if wood comes from sustainable forests in North America).

5.5.2 Calculating Carbon Content of Product in Cradle-to-gate EPDs

The users of this PCR document shall report the carbon content of the products ready for shipment at the facility gate under additional environmental information (see Section 5.6) as well as the fraction of this carbon that is from biogenic origin. The procedure described in ISO/TR 14047:2012, Example 3 for the calculation of net contribution to GWP from greenhouse gas (GHG) emissions and carbon sinks on

forestry activities shall be applied to calculate biogenic carbon dioxide (CO_2) contribution to the GWP impact indicator (in the absence of situations involving deforestation or significant reductions in average regional forest carbon stocks). Note that this PCR document provides guidelines for cradle-to-facility gate environmental performance reporting only; the methodology stated in Section 6.4.3.9.3 of ISO/TR 14047:2012 for the calculation of the effect of carbon stored in products in use does not apply to this PCR document.

The carbon balance method described below shall be applied to calculate and report carbon content in the product and the fraction of this carbon from biogenic origin.

The carbon content of the product as well as the fraction of this carbon from biogenic origin shall be calculated using the carbon balance method and equations provided below. The carbon balance below excludes the use of fossil fuels (input = output) but includes the use of carbon-containing fossil functional chemicals for which the carbon will remain in the product (e.g., starch, calcium carbonate).

The carbon content of the product ($C_{P,}$ kg C/kg product) is calculated using the following equations (note that for some products, some of the terms within these equations will be zero):

$C_P = C_{In} - C_{Out}$
$C_{In} = C_{WF} + C_{RF} + C_{MP} + C_{FC,Bio} + C_{FC,Non\text{-}Bio}$
$C_{Out} = C_E + C_{Pr} + C_{BL} + L$

Where:

C_{In} – Carbon in inputs to the manufacturing facility (kg C/kg product); and
C_{Out} – Carbon in outputs from the manufacturing facility (kg C/kg product).
C_{WF} – Carbon in wood fiber input (kg C/kg product);
C_{RF} – Carbon in recycled fiber input (kg C/kg product);
C_{MP} – Carbon in purchased market pulps (kg C/kg product, paper products only);
$C_{FC,Bio}$ – Carbon in functional chemicals from biogenic origin (kg C/kg product, e.g., starch);
$C_{FC,Non\text{-}Bio}$ – Carbon in functional chemicals not from biogenic origin (kg C/kg product, make-up calcium carbonate of mineral origin);
C_E – Carbon emissions from biomass combustion (kg C/kg product);
C_{BL} – Carbon emissions from black liquor combustion (kg C/kg product);
C_{Pr} –Biogenic carbon in process emissions (kg C/kg product); and
L – Other carbon losses during pulp manufacturing (e.g. black liquor loss, bleaching, etc., kg C/kg product).

The carbon content can also be expressed in units of CO_2 eq. by multiplying by 3.67 kg CO_2/kg C.

The fraction of carbon content from biogenic CO_2 (f_{Bio}) is estimated as follows assuming most carbon in purchased pulps and recycled fiber will be of biogenic origin:

$f_{Bio} = (C_{WF} + C_{RF} + C_{MP} + C_{FC,Bio} - C_E - C_{Pr} - C_{BL} – L)/C_P$

Inputs - Wood Fiber Input (C_{WF}): The first element of the equation is the carbon in wood fiber delivered to market pulp or intermediate paper product manufacturing facilities as raw material input. The total wood input (pulpwood, purchased residues, etc.) to the facility needs to be considered including that

that will end up the product ready for shipment at the facility gate[9] and that being used for energy. The carbon content in wood fiber can be obtained from measurements or derived from the literature.

Inputs – Recycled Fiber Input (C_{RF}): If the product under study uses recycled fiber, the carbon content of recycled fiber delivered to market pulp or intermediate paper product manufacturing facilities needs to be included in the carbon balance. The carbon content in wood fiber can be obtained from measurements or derived from the literature.

Inputs – Purchased Market Pulps (C_{MP}): If the product under study (paper products only) is manufactured from a fraction of purchased market pulps, the carbon content of the purchased market pulps delivered to the intermediate paper product manufacturing facilities needs to be included in the carbon balance. The carbon content in purchased pulp can be obtained from measurements, from carbon balances or from the literature.

Inputs – Functional Chemicals ($C_{FC,Bio}$ and $C_{FC,Non-Bio}$): The carbon in functional chemicals will end up in the product ready for shipment at the facility gate. Functional chemicals can be from biogenic origin (e.g., starch) or not (e.g., calcium carbonate). The carbon content in purchased pulp can be from actual measurements, from a carbon balance or derived from the literature.

Outputs – Carbon from Biomass Combustion: The first output of carbon that needs to be accounted for in the carbon balance is the CO_2 from burning wood fuels (e.g., self-generated or purchased residues).

Outputs – Carbon from Black Liquor Combustion (C_{BL}): Carbon in black liquor will be emitted back to the atmosphere when burned for energy in the recovery boiler.

Outputs – Carbon in Process Emissions (C_{Pr}): In some cases, the pulp and papermaking process will generate emissions of CO_2 that are not from energy production. For instance, CO_2 can be released from kraft mill lime kilns. These emissions need to be accounted for into the carbon balance. Emissions from kilns are typically difficult to characterize because they are from two main sources: releases from wood-derived $CaCO_3$ in the calcining process, and CO_2 from fossil fuels burned in the kiln. Only the emissions from biomass need to be included in the carbon balance for estimating the carbon content of the product. In the absence of better information, it can be assumed that 2/3rd of the CO_2 releases from lime kilns are of biogenic origin (Miner and Upton 2002). In some instance, CO_2 from lime kiln will be captured to produce calcium carbonate used as an additive to papermaking. This also needs to be accounted for in the carbon balance where significant.

Outputs – Other Carbon Losses (L): Other carbon losses include carbon in black liquor discharged via sewer to waste treatment (assume this carbon will go back to atmosphere through biological activity), carbon in solid waste sent to disposal, carbon losses from bleaching, etc.). Either facility-specific loss rates from pulp manufacturing or estimates based on literature can be applied in the carbon balance calculations.

Allocation procedure stated in Section 5.3 of the main PCR shall be applied to allocate wood fiber inputs and carbon emissions between pulp and co-products such as turpentine and soap produced during pulp production. The formula below can be applied to calculate the carbon balance using the allocated wood fiber input and carbon emissions.

[9] The facility operating data and inventory records would serve the purpose of this analysis.

5.6 Additional Environmental Information

EPDs created using this PCR document shall include, at minimum:

- the categorization of sources of wood fiber according to their forest management or certification systems, in accordance with ASTM D7612-10;
- the total removals of biogenic CO_2 associated with the product under study (carbon uptake by forest, to be set equal to the carbon content of wood, expressed in CO_2 eq.);
- the total releases of biogenic CO_2 (for instance through combustion or degradation of materials sent to disposal);
- the carbon stored in mill landfills (where applicable); and
- the carbon content of the product studied (in kg C/kg product) and the fraction of this carbon that is from biogenic origin.

In addition, where the wood used to produce the studied product is not derived from sustainable forest management or where it can be documented that its supply results in change in long-term carbon stocks (positive or negative), EPDs created using this PCR should also document the change in carbon stocks attributable to the studied product, expressed in CO_2 eq. per declared unit. The method used to estimate the change in long-term carbon stocks, the source of data as well as the allocation method to attribute changes in carbon stocks to the studied product should be documented[10]. At a minimum, change in carbon stocks shall be discussed.

Further to the above, EPDs created using this PCR document may include the following additional information:

- information on the biodiversity aspects of the studied product (e.g., how the list of federally protected species is affected in the broad region in which wood is sourced); and
- water consumption (in liters).

EPDs created using this PCR document shall also include other additional information related to environmental aspects listed in ISO 14025, Section 7.2.3, if relevant for the intended use.

All additional environmental information included in the EPD shall be separated from the environmental information derived from LCA, LCI or information modules and they shall conform to ISO 14025, Section 7.2.4.

Finally, EPDs developed based on this PCR document shall contain a statement that EPDs do not address all aspects of environmental sustainability concerns.

6 Content of the EPD

EPDs created using this PCR document shall include the information discussed below:

[10] This can be done, for instance, using the methods presented in Appendix B of the World Resource Institute (WRI)/World Business Council for Sustainable Development (WBCSD) GHG Protocol *Product Life Cycle Accounting and Reporting Standard*.

PROGRAM RELATED INFORMATION

- Name of the program and name and address of program operator
- Reference to this PCR document, including the date of issue
- Registration number of the EPD
- Date of publication and period of validity of the EPD

PRODUCT RELATED INFORMATION

- Names and addresses of the manufacturing company or group of companies or those representing them for whom the results of the LCA are representative and making the environmental declaration
- The name of the company/organization as well as the manufacturing sites shall be provided in the EPD. In addition, general information about the company/organization, such as the existence of quality systems, or environmental management system according to ISO 14001, environmental policy or company's environmental policy may also be included in the EPD.
- Declared unit
- Content of materials and chemical substances
- Comparisons of EPDs within one specific product category covered by this PCR shall be based on this particular PCR. However, EPDs cannot be used to compare within pulp types or paper grades. The user of the EPD information should be made aware of this by the inclusion of this statement in the EPD: "EPDs cannot be used to compare within pulp types or paper grades (including pulp and paper products with different recycled fiber contents)". In addition, ISO 14025 requires a statement to be included to indicate that, "EPDs from different programs may not be comparable"
- Statement that declaration represents an average performance, where an EPD declares an average performance of a product produced by a number of manufacturers
- Additional details to be declared in the EPD are provided in the PCR modules (see the product category definition of the relevant PCR module)

VALIDITY OF THE EPD

The geographical area and the time during which the EPD is valid shall be reported in the EPD. EPDs published using this PCR document are valid for a maximum of 5 years from the date of publication.

ENVIRONMENTAL PERFORMANCE-RELATED INFORMATION

The parameters of the environmental impacts, discussed in Section 5.4 from the underlying LCA study, shall be reported per declared unit. Upstream module and core module shall be reported separately for the environmental impacts together with the reference year or period of the underlying primary LCA data collected for the EPD.

USE OF RESOURCES

Consumption of natural resources (i.e., both material and energy resources) discussed in Section 5.4 shall be reported per declared unit.

OTHER INDICATORS

The other indicators discussed in Section 5.4 shall be reported per declared unit.

ADDITIONAL ENVIRONMENTAL INFORMATION

The additional environmental information described in Section 5.6 shall be reported in the EPDs.

EPD VERIFICATION

The verification rules of the program operator shall be followed, and the following Demonstration of Verification shall be completed and included with the EPD.

Demonstration of Verification

PCR review was conducted by: (organization and name of the chair, and information on how to contact the chair through the program operator)
Independent verification of the EPD and data, in accordance with ISO 14025 (please circle or check): Internal External
Third party verifier if applicable: (name of the third party verifier))

EXPLANATORY MATERIALS

Type III environmental declaration shall provide where explanatory material (e.g., third party verification report) can be obtained from.

7 PCR Module 1 – Market Pulp

7.1 Definition of the Product Category

Market pulp is any type of pulp[11] dried and ready to be shipped at the mill gate for further processing into various final products, mainly paper and paperboard. The product category includes all the varieties of market pulp manufactured in North America. It includes mechanical pulp, chemical pulp, chemi-mechanical pulp, bleached chemithermomechanical pulp, recycled pulp etc. described under the subcategories 32112 (i.e., chemical wood pulp, other than dissolving grades) and 32113 (i.e., mechanical wood pulp; semi-chemical wood pulp; pulps of fibrous cellulosic material other than wood) of the CPC (Central Product Classification) product group 321. The EPDs produced using this PCR document shall report potential uses of market pulp. This product category does not include dissolving grades.

7.1.1 Additional Product Related Information to be declared in the EPD

In addition to the product related information described in the main PCR, the following product-related information shall be declared in the EPD:

- Market pulp grade

Specification of the pulp (brightness, SW and HW content, etc.), including a simple visual representation.

7.1.2 Content of Material and Chemical Substances

In addition, the EPD shall declare the moisture content, virgin or recycled raw material contents, and chemical substances at a minimum of 99% of the total market pulp at the facility gate.

7.2 Requirements for the Underlying LCA

7.2.1 Scope Definition for the LCA

7.2.1.1 Declared Unit

Market pulp ready for shipping at the mill gate is an intermediate product for which the function and the reference scenario for the whole life cycle cannot be stated. As a result, a functional unit cannot be defined to normalize the inventory flows because there is no use phase involved in the analysis to define functions of the product system. The concept of declared unit is deemed more applicable than a functional unit for this kind of analysis. The declared unit shall be one air dried metric tonne of saleable [10% of moisture] pulp grade at the mill's gate with the following quality parameters to be specified.

- Brightness
- Softwood (SW) content on an air dried metric tonne basis
- Hardwood (HW) content on an air dried metric tonne basis
- Recycled content

The mill's gate is the pulp warehouse at the primary manufacturer where pulp is stored for shipping (warehouse activities included).

[11] Different pulp types are not necessarily functionally equivalent

7.2.1.2 System Boundary

The system boundary for the LCA is depicted in Figure 1. The system boundary is cradle-to-gate and shall include all relevant upstream and core processes discussed below. This PCR document does not include market pulp after leaving the mill gate and its use to manufacture secondary products and their use and disposal.

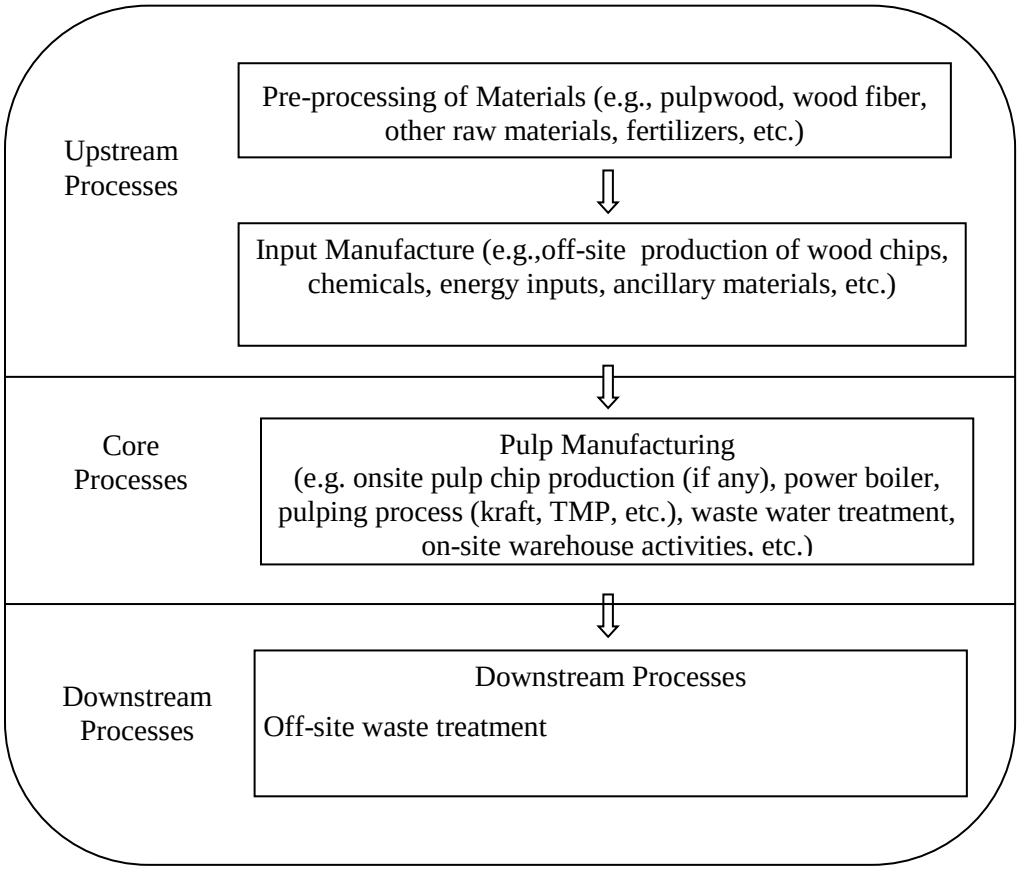

Figure 1 System boundary for LCA for market pulp

Upstream Processes – *Raw material Acquisition and Pre-processing; and manufacturing of materials*
Upstream processes shall include the inflow of all the raw materials and energy inputs used for the manufacture of market pulp. Material acquisition shall start with resource extraction from nature and preprocessing and manufacture of raw materials and energy inputs received at the facility gate shall be included. The cradle-to-facility gate raw material acquisition and pre-processing processes are:

- Transportation within and between extraction and pre-processing facilities, and to the production facility;
- Distribution and storage processes (e.g. warehousing and use of vehicles such as cranes);
- The production of fuels, electricity and heat (off-site production), and ancillary materials used in the pulp production;
- The production of chemicals used in pulp and pulp production

- The production of packaging material used in products (including for example paper, paperboard, plastic);
- Wood-based raw materials
  - ✓ Forestry processes: seedling production, silviculture (cut over clearing, soil preparation, planting, cleaning and fertilization); logging (thinning/final felling and extraction of pulpwood/timber);
  - ✓ Production of off-site woodchips and bark (e.g. the forestry processes listed above, transportation to a chipping place and chipping itself.);

Core Processes – Market pulp production:
The production stage begins with the inflow of material and energy inputs at the facility gate and ends when the market pulp leaves the facility gate. The facility gate of a pulp mill is the pulp warehouse.

The core processes include the following:

- Supporting activities for pulp (e.g. water treatment, wastewater treatment, power and steam generation, chemical recovery, waste handling and on-site treatment, etc.);
- Internal material handling (e.g. transportation of inputs, warehousing and use of vehicles such as forklifts);
- Pulp production (e.g. if any on-site pulp chip production (de-barking and chipping), pulping process, refining, screening, cleaning, bleaching, drying and storage of pulp);
- Treatment of waste generated from pulp manufacture (e.g. sludge from waste water treatment plant);
- Off-site waste transport to a disposal site (e.g. boiler ash to landfill or a recycling facility);
- On-site warehouse activities.

Downstream Processes – Off-site waste treatment:
Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

7.2.2 Life Cycle Inventory Analysis

7.2.2.1 Upstream Module

All the inventory flows at resource extraction, other than the flows falling under the cut-off rules stated in Section 5.3, shall be included in the system boundary. Site-specific or generic data (i.e., commonly available data sources such as commercial databases and free databases) should be used for the LCI, describing specific raw materials or processes. If these site-specific or generic data are not available, data from literature may be used and documented. Wherever possible, specific data for the following upstream production activities in forestry is recommended to use:

- Extraction (removal) of raw materials including reforestation and forest management;
- Average or specific transportation of raw materials (including recycled materials) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process);
- Pulp chip production

7.2.2.2 Core Module

All the processes occurring at the facility shown in the list in Section 7.2.1.2 for the market pulp production shall be included. All the flows that meet cut-off criteria stated in Section 5.3, including

packaging shall be included. Data may be calculated as an average of multiple years. Capital equipment and infrastructure, and human activities shall not be included in the system boundary.

7.2.2.3 Downstream Module

Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

7.2.2.4 Allocation Rules

Co-Products: Allocation procedure described in Section 5.3 of the main PCR shall be applied.

Treatment of Recycled Fiber Inputs: Allocation procedure stated in Section 5.3 of the main PCR for recycled fiber inputs shall be applied.

8 PCR Module 2 – Paper and Paperboard Products

8.1 Definition of the Product Category

This product category includes the following paper and paper products described under UN CPC classes 3212 and 3214.

- CPC 32129 Uncoated paper and paperboard, of a kind used for writing, printing or other graphic purposes
- CPC 32143 Paper and paperboard coated with kaolin or other inorganic substances

The product category does not include newsprint; hand-made paper and paperboard; composite paper and paperboard that is not surface-coated or impregnated; paper and paperboard that is creped, crinkled, embossed or perforated or impregnated; or other paper and paperboard, cellulose wadding and webs of cellulose fibers, coated, impregnated, gummed or adhesive, covered, surface-coloured, surface-decorated or printed, in rolls or sheets.

8.1.1 Additional Product Related Information to be Declared in the EPD

In addition to the product related information described in the main PCR, the following product-related information shall be declared in the EPD:

- Trade name (if relevant), and the type (if applicable) of the paper product shall be declared

Type I environmental labels (if awarded) and Type II Self-Declarations may be stated in the EPD. Any claims made about the product shall be verifiable.

8.1.2 Content of Material and Chemical Substances

The EPD shall include a description of the paper product and its intended uses, including the product classification number according to the UN CPC classification system. The gross weight of materials shall be declared in the EPD at a minimum of 99% of the paper product at the facility gate.

The following information about the paper product shall be stated:

- Type of pulp or type of recovered paper
- Bleaching agents
- Functional chemicals, if present in the paper product at more than 2% by mass e.g., starch coating, retention aid, strength agents, etc.
- Process chemicals, if present in the paper product at more than 2% by mass e.g., caustic, sulfuric acid, bleaching chemicals, biocides, etc.

8.2 Requirements for the Underlying LCA

8.2.1 Scope

8.2.1.1 Declared Unit

The declared unit shall be one ream of paper (500 sheets of paper) or one tonne of air dry paper ready for shipment at the manufacturing facility gate. If ream of paper is used, air dry weight of the ream of paper shall be reported. The mill's gate is the warehouse at the primary manufacturer where final paper product is stored for shipping (warehouse activities included).

8.2.1.2 System Boundary

The system boundary for the LCA is depicted in Figure 2. The system boundary is cradle-to-gate and shall include all relevant upstream and core processes discussed below. This PCR module does not include life cycle stages subsequent to the paper products leaving the mill gate and their use and disposal.

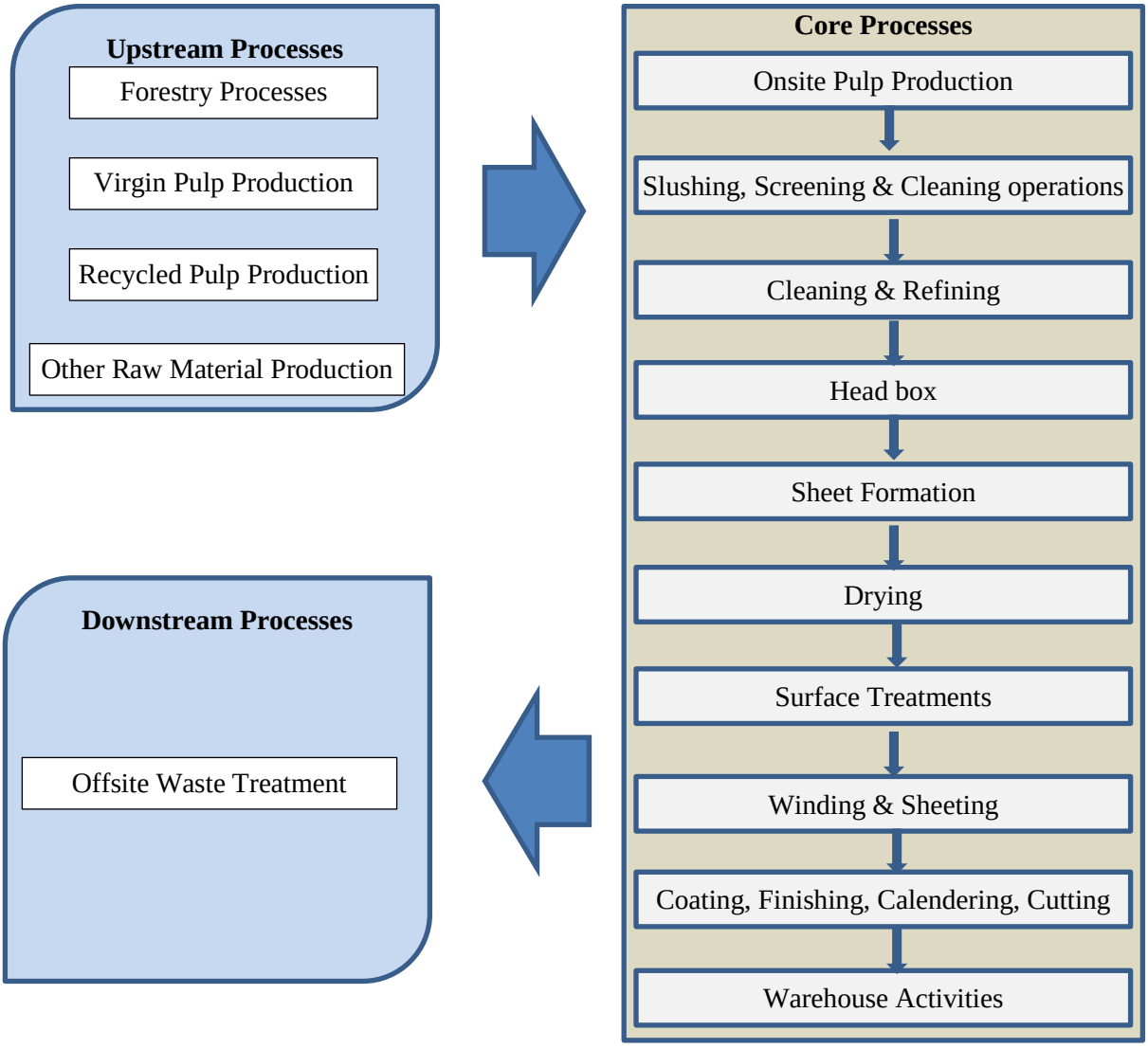

Figure 2 System boundary for LCA for paper and paperboard production

Upstream Processes – ***Raw material Acquisition and Pre-processing; and manufacturing of materials***
Upstream processes shall include the inflow of all the raw materials and energy inputs used for the manufacture of paper and paperboard. Material acquisition shall start with resource extraction from forests and preprocessing and manufacture of raw materials and energy inputs received at the facility gate shall be included. The cradle-to-facility gate raw material acquisition and pre-processing processes are:

- Transportation within and between extraction and pre-processing facilities, and to the production facility;
- Distribution and storage processes (e.g. warehousing and use of vehicles such as forklifts);
- The production of fuels, electricity and heat (off-site production), and ancillary materials used in the pulp and paper production;
- The production of chemicals used in the pulp and paper production,
- The production of coating substances such as kaolin or other inorganic substances, where relevant;
- The production of product packaging material used;
- Wood-based raw materials
  - ✓ Forestry processes: seedling production, silviculture (cut over clearing, soil preparation, planting, cleaning and fertilization); logging (thinning/final felling and extraction of timber);
  - ✓ Production of off-site woodchips and bark (e.g. the forestry processes listed above, transportation to a chipping place and chipping itself.);
  - ✓ Market pulp production

Core Processes – Paper production:
The production stage begins with the inflow of material and energy inputs at the facility gate and ends when the paper leaves the facility gate. The facility gate is the paper warehouse.
The core processes include the following:

- Material and energy transportation to paper mill
- Onsite pulp production, if any
- Supporting activities of paper production (e.g. water treatment, wastewater treatment, power and steam generation, chemical recovery, waste handling and on-site treatment, etc.);
- Internal material handling (e.g. transportation of inputs, warehousing and use of vehicles such as forklifts);
- Paper production (e.g. manufacturing/preparation/packaging);
- Impacts from internal electricity production, if relevant;
- Treatment of waste generated from paper manufacture (e.g. sludge from waste water treatment plant, rejects from recycled furnish re-pulping);
- Off-site waste transport to a disposal site (e.g. boiler ash to landfill);
- On-site warehouse activities.

Downstream Processes – Off-site waste treatment
Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

8.2.2 Life Cycle Inventory Analysis

8.2.2.1 Upstream Module

All the inventory flows at resource extraction, other than the flows falling under the cut-off rules stated in Section 5.3, shall be included in the system boundary. Site-specific or generic data (i.e., commonly available data sources such as commercial databases and free databases) should be used for the LCI, describing specific raw materials or processes. If these site-specific or generic data are not available, data from literature may be used and documented. Wherever possible, specific data for the following upstream production activities in forestry is recommended to use:

- Extraction (removal) of raw materials including reforestation and forest management;

- Average or specific transportation of raw materials (including recycled materials) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process);
- Pulp chip production
- Pulp production

8.2.2.2 Core Module

All the processes occurring at the facility shown in the list above for the paper production shall be included. All the flows that meet cut-off criteria stated in Section 5.3, including product packaging shall be included. Data may be calculated as an average of multiple years. Capital equipment and infrastructure, and human activities shall not be included in the system boundary.

8.2.2.3 Downstream Module

Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

8.2.2.4 Allocation Rules

Co-Products: Allocation procedure described in Section 5.3 of the main PCR shall be applied.

Treatment of Recycled Fiber Inputs: Allocation procedure stated in Section 5.3 of the main PCR for recycled fiber inputs shall be applied.

Where multiple papermaking lines or converting lines that produce more than one paper type are involved, allocation shall be avoided by dividing unit processes into sub-processes. If there is lack of line level monitoring of energy and material inputs, the input flows should be assigned to each paper type based on their physical output flows, i.e., by mass.

8.2.2.5 Boundaries to Other Product Life Cycles

For recycled materials that are used in the production phase, transportation to where they are used should be included. For production waste or residuals, transportation to where they are actually managed and emission from their management should be included. No credits should be given for the actual beneficial use function.

9 PCR Module 3 – Tissue Products

9.1 Definition of the Product Category

This product category contains tissue products consisting of at least 90% cellulose based natural fibers (virgin, recycled or mixed). The product group includes toilet or facial tissue stock, towel or napkin stock and similar paper, cellulose wadding and webs of cellulose fibers described under the subcategory 32131 of the CPC (Central Product Classification) product group 321 and class 3213. Kraftliner, kraft paper, wrapping paper, testliner sulphite wrapping paper and tracing papers are excluded from this product category.

9.1.1 Additional Product Related Information to be Declared in the EPD

In addition to the product related information described in the main PCR, the following product-related information shall be declared in the EPD:

- Trade name (if relevant) and the variety (if applicable) of the tissue product shall be declared
- Type I and Type II environmental labels, if awarded, may be stated in the EPD. Any claims made about the product shall be verifiable.

9.1.2 Content of Material and Chemical Substances

The EPD shall include a description of the tissue product and its intended uses, including the product classification number according to the UN CPC classification system. The gross weight of materials shall be declared in the EPD at a minimum of 99% of the tissue product at the facility gate.

The following information about the tissue product shall be stated:

- Type of pulp or type of recovered paper
- Bleaching agents
- A list of functional chemicals shown in Table 2, if present in the tissue product more than 2% by mass
- A list of process chemicals shown in Table 3 if present in the tissue product more than 2% by mass

Table 2 Functional chemicals present in final tissue product

Additive	Function/main use
Wet strength agent	Enables tissue product to retain a proportion of its dry strength when it becomes wet. Active ingredients depend on pH in the tissue production process.
Dry strength agent	Increases the tensile and other strength properties
Dye	Water soluble and absorbed on the fiber surface.
Fixing agents	Help ensure absorption of the dyes on to the fibers
Fluorescent whitening agent	Add extra whiteness to the tissue.
Glue: laminating glue, pick up glue, tail, seal glue	Glue multiple flat tissue layers together.
Softeners, debonders, absorbency aids	Improve surface softness.
Lotions, perfumes, detergents	

Source: Public Health Committee, Policy Statement concerning tissue paper, kitchen towels and napkins v1-2004.

Table 3 Process chemicals added during processing at a rate greater than 2% by mass of dry fiber

Additive	Function/main use
Antipitch	Prevent the adhesion of pitch to the tissue making equipment
Protection agent	Protect during production process and storage of product
Yankee coating component (adhesives and release agents)	Control the creeping process
Defoamers – surface active agents	Prevent excessive foaming during production.
pH and charge control	Add to obtain optimum pH during the manufacturing
Retention aids	Assist the efficiency of the filtration process
Surfactant components	Remove ink from the waste paper
Broke treatment chemicals	Discolour broke and breaking down wet strength agents
Drainage aid	Improve the removal of water in the tissue production process

Source: Public Health Committee, Policy Statement concerning tissue paper, kitchen towels and napkins v1-2004.

9.2 Requirements for the Underlying LCA

9.2.1 Scope

9.2.1.1 Declared Unit

The declared unit shall be one tonne of air dry tissue ready for shipment at the mill gate. In addition to this declared unit, the following alternative units may be used;

- One square meter of tissue
- The amount of tissue required to absorb one gram of water
- Amount of tissue required for a specified function, e.g., amount of tissue needed for one hand drying application

If the alternate declared units are used then the weight shall be reported. The mill's gate is the warehouse at the primary manufacturer where tissue is stored for shipping (warehouse activities included).

9.2.1.2 System Boundary

The system boundary for an LCA is depicted in Figure 3. The system boundary is cradle-to-gate and shall include all relevant upstream and core processes discussed below. This PCR module does not include life cycle stages subsequent to the tissues leaving the mill gate and their use and disposal.

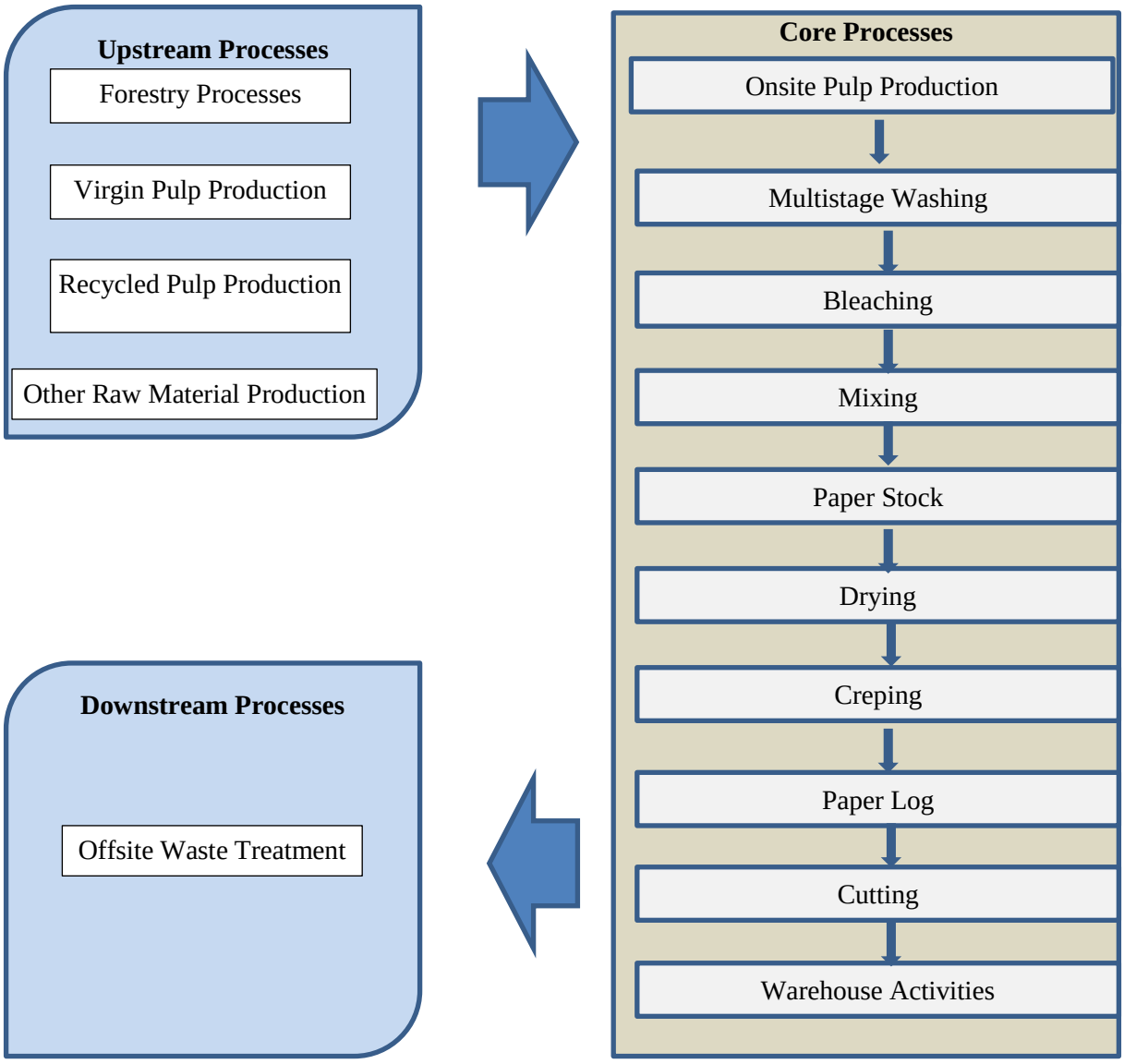

Figure 3 System boundary for LCA for tissue products

Upstream Processes – ***Raw material Acquisition and Pre-processing; and manufacturing of materials***
Upstream processes shall include the inflow of all the raw materials and energy inputs used for the manufacture of tissues. Material acquisition shall start with resource extraction from forests and preprocessing and manufacture of raw materials and energy inputs received at the facility gate shall be included. The cradle-to-facility gate raw material acquisition and pre-processing processes are:

- Transportation within and between extraction and pre-processing facilities, and to the production facility;
- Distribution and storage processes (e.g. warehousing and use of vehicles such as cranes);
- The production of fuels, electricity and heat (off-site production), and ancillary materials used in the tissue production;
- The production of chemicals used in the tissue production
- The production of product packaging material (including, for example, paper, paperboard, plastic);
- Wood-based raw materials
  - ✓ Forestry processes: seedling production, silviculture (cut over clearing, soil preparation, planting, cleaning and fertilization); logging (thinning/final felling and extraction of timber);
  - ✓ Production of off-site woodchips and bark (e.g. the forestry processes listed above, transportation to a chipping place and chipping itself.);
  - ✓ Pulp production

Core Processes – Tissue production:
The production stage begins with the inflow of material and energy inputs at the facility gate and ends when the tissue leaves the facility gate. The facility gate of a tissue mill is the tissue warehouse.
The core processes include the following:

- Material and energy transportation to tissue mill
- Supporting activities of tissue production (e.g. water treatment, wastewater treatment, power and steam generation, chemical recovery, waste handling and on-site treatment, etc.);
- Internal material handling (e.g. transportation of inputs, warehousing and use of vehicles such as forklifts);
- Tissue production (e.g. tissue manufacturing/preparation/packaging);
- Impacts from internal electricity production if relevant;
- Treatment of waste generated from tissue manufacture (e.g. sludge from waste water treatment plant);
- Off-site waste transport to a disposal site (e.g. boiler ash to landfill or a recycling facility);
- On-site warehouse activities.

Downstream Processes – Off-site waste treatment
Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

9.2.2 Life Cycle Inventory Analysis

9.2.2.1 Upstream Module

All the inventory flows at resource extraction, other than the flows falling under the cut-off rules described in Section 5.3, shall be included in the system boundary. Site-specific or generic data (i.e., commonly available data sources such as commercial databases and free databases) shall be used for the LCI, describing specific raw materials or processes. If these site-specific or generic data are not available,

data from literature may be used and documented. Wherever possible, specific data for the following upstream production activities in forestry is recommended to use:

- Extraction (removal) of raw materials including reforestation and forest management;
- Average or specific transportation of raw materials (including recycled materials) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process);

9.2.2.2 Core Module

All the processes occurring at the facility shown in the list above for the tissue production shall be included. All the flows that meet cut-off rules stated in Section 5.3, including packaging shall be included. Data may be calculated as an average of multiple years. Capital equipment and infrastructure, and human activities shall not be included in the system boundary.

9.2.2.3 Downstream Module

Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

9.2.2.4 Allocation Rules

Co-Products: Allocation procedure described in Section 5.3 of the main PCR shall be applied.

Treatment of Recycled Fiber Inputs: Allocation procedure stated in Section 5.3 of the main PCR for recycled fiber inputs shall be applied.

Where multiple papermaking lines or converting lines that produce more than one tissue type are involved, allocation shall be avoided by dividing unit processes into sub-processes. If there is lack of line level monitoring of energy and material inputs, the input flows should be assigned to each tissue type based on their physical output flows, i.e., by mass.

9.2.2.5 Boundaries to Other Product Life Cycles

For other recycled materials that are used in the production phase, transportation to where they are used should be included. For production waste or residuals, transportation to where they are actually managed and emission from their management should be included. No credits should be given for the actual beneficial use function.

10 PCR Module 4 – Containerboard

10.1 Definition of the Product Category

This PCR module covers containerboard as defined under Class 3215 and subclass 32151 in the UN CPC system.

10.1.1 Additional Product Related Information to be Declared in the EPD

In addition to the product related information described in the main PCR, the following product-related information shall be declared in the EPD:

- A description of the product and its intended use together with its classification number according the UN CPC classification system shall be stated
- Basis weight of the product shall be declared.

Type I and Type II environmental labels, if awarded, may be stated in the EPD. Any claims made about the product shall be verifiable.

10.1.2 Content of Material and Chemical Substances

The EPD shall state the gross weight of material at a minimum of 99% of one declared unit of the product as defined in 10.2.1.1 below.

10.2 Requirements for the Underlying LCA

10.2.1 Scope

10.2.1.1 Declared Unit

The declared unit shall be one tonne (1000kg) of the air dry product ready for shipment at the facility gate. The facility gate is the warehouse at the manufacturer where the product is stored for shipping (warehouse activities included).

10.2.1.2 System Boundary

The system boundary for the LCA is depicted in Figure 4. The system boundary is cradle-to-gate and shall include all relevant upstream and core processes discussed below. This PCR module does not include life cycle stages subsequent to the product leaving the mill gate and its use and disposal.

Upstream Processes – ***Raw material Acquisition and processing; and manufacturing of the product***
Upstream processes shall include the inflow of all the raw materials and energy inputs used for the manufacture of containerboard. Material acquisition shall start with resource extraction from forests and preprocessing and manufacture of raw materials and energy inputs received at the facility gate shall be included. The upstream processes are:

- Production of paper inclusive of forestry processes and pulp production;
- Recycling process of recycled paper including transport from recycling facility to a place where recycled paper is used;
- Production of fuels, electricity and heat (off-site production);
- Production of ancillary materials (off-site production);

- Production of pigments, additives, and other chemicals used in the downstream core processes;
- The production of packaging material used in products;

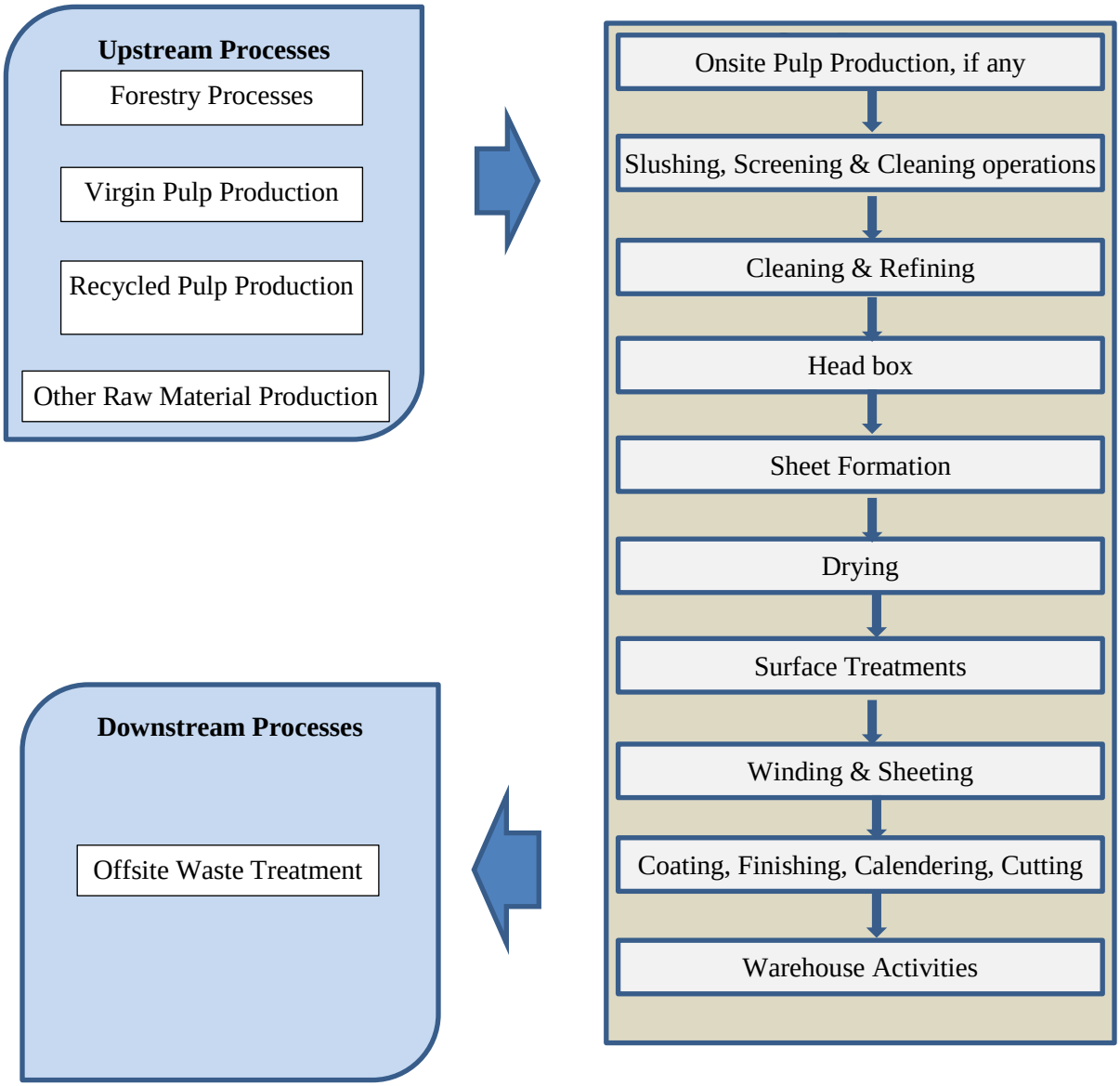

Figure 4 System boundary for LCA for containerboard

Core Processes (production of containerboard):
The production stage begins with the inflow of material and energy inputs at the facility gate and ends when the paper leaves the facility gate. The facility gate is the paper warehouse.
The core processes include the following:

- Material and energy transportation to paper mill
- Onsite pulp production, if any
- Supporting activities of paper production (e.g. water treatment, wastewater treatment, power and steam generation, chemical recovery, waste handling and on-site treatment, etc.);
- Internal material handling (e.g. transportation of inputs, warehousing and use of vehicles such as forklifts);
- Paper production (e.g. manufacturing/preparation/packaging);
- Impacts from internal electricity production, if relevant;
- Treatment of waste generated from paper manufacture (e.g. sludge from waste water treatment plant, rejects from recycled furnish re-pulping);
- Off-site waste transport to a disposal site (e.g. boiler ash to landfill);
- On-site warehouse activities.

Downstream Processes – Off-site waste treatment
Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling)

10.2.2 Life Cycle Inventory Analysis

10.2.2.1 Upstream Module

All the inventory flows at resource extraction, other than the flows falling under the cut-off rules described in Section 5.3, shall be included in the system boundary. Site-specific or generic data (i.e., commonly available data sources such as commercial databases and free databases) should be used for the LCI, describing specific raw materials or processes. If LCI data are not available, non-LCI data from literature may be used and documented.

10.2.2.2 Core Module

All the processes occurring at the facility shown in the list above for the paper production shall be included. All the flows that meet cut-off criteria stated in Section 5.3, including product packaging shall be included. Data may be calculated as an average of multiple years. Capital equipment and infrastructure, and human activities shall not be included in the system boundary.

10.2.2.3 Downstream Module

Off-site treatment of waste generated from core processes, if any, shall be included (e.g., landfilling).

10.2.2.4 Allocation Rules

Co-Products: Allocation procedure described in Section 5.3 of the main PCR shall be applied.

Treatment of Recycled Fiber Inputs: Allocation procedure stated in Section 5.3 of the main PCR for recycled fiber inputs shall be applied.

Production waste: Allocation procedure described in Section 5.3 of the main PCR shall be applied.

In addition, allocation rules apply to manufacturing processes producing more than one kind of containerboard. Allocation shall be avoided if the input flows can be traced to the containerboard type. Where there is lack of monitoring of energy and material inputs by the product type, the input flows should be assigned to each product based on the physical output flows, i.e., by mass.

10.2.2.5 Boundaries to Other Product Life Cycles

For other recycled materials that are used in the production phase, transportation to where they are used should be included. For production waste or residuals, transportation to where they are actually managed and emission from their management should be included. No credits should be given for the actual beneficial use function.

Annex 1: List of Toxic Substances

Substances	Manufactured (Inadvertently or not)	Processed	Otherwise Used
Acetaldehyde - Pulp and Paper	yes	not generally	not generally
Acrolein - Pulp and Paper	yes	not generally	not generally
alpha-Pinene - Pulp and Paper	yes	not applicable	not applicable
Ammonia - Pulp and Paper	yes	dyes, coatings, inks	PM pH adjusters, wastewater nutrients, use in ammonium-based sulphite pulping, NOx emission control
Arsenic and its Compounds - Pulp and Paper	yes	wood, recycled paper, papermaking additives	wood fuel, coal, oil, alternative fuels, kraft pulping chemicals
Benzene - Pulp and Paper	yes	not generally	solvents, cleaning products
beta-Pinene - Pulp and Paper	yes	not applicable	not applicable
Cadmium and its Compounds - Pulp and Paper	yes	wood, recycled paper, papermaking additives	wood fuel, coal, oil, alternative fuels, kraft pulping chemicals
Carbon Disulphide - Pulp and Paper	yes	not generally	not generally
Carbon Monoxide - Pulp and Paper	yes	not applicable	not applicable
Chlorine - Pulp and Paper	yes	not generally	pulp bleaching, effluent treatment, raw water treatment
Chlorine Dioxide - Pulp and Paper	yes	not generally	pulp bleaching
Chloroform - Pulp and Paper	yes	not generally	not generally
Chloromethane - Pulp and Paper	yes	not generally	not generally
Chromium and its Compounds - Pulp and Paper	yes	wood, recycled paper, papermaking additives	Corrosion prevention in cooling towers, salt cakes, wood fuel, coal, oil, alternative fuels, kraft pulping chemicals
Copper and its Compounds - Pulp and Paper	yes	not generally	not generally
Cresol - Pulp and Paper	yes	not generally	not generally
Dioxin and Furan Congeners - Pulp and Paper	yes	not generally	not generally
D-Limonene - Pulp and Paper	yes	not applicable	not applicable
Ethyl Alcohol - Pulp and Paper	yes	not applicable	not applicable

Ethylene Glycol - Pulp and Paper	yes	not generally	ink, anti-freeze, heat exchange fluids, biocides
Formaldehyde - Pulp and Paper	yes	papermaking additives, paper coating chemicals	glues, resins, defoamers, biocides
Hexavalent Chromium Compounds - Pulp and Paper	yes	wood, recycled paper, papermaking additives	Corrosion prevention in cooling towers, salt cakes, wood fuel, coal, oil, alternative fuels, kraft pulping chemicals
Hydrochloric Acid - Pulp and Paper	yes	not generally	boiler descaling, equipment cleaning operations
Hydrogen Sulphide - Pulp and Paper	yes	not generally	not generally
Isopropyl Alcohol - Pulp and Paper	yes	not generally	not generally
Lead and its Compounds - Pulp and Paper	yes	wood, recycled paper, papermaking additives	wood fuel, coal, oil, alternative fuels, kraft pulping chemicals
Manganese and its Compounds - Pulp and Paper	yes	wood, recycled paper	wood fuel, coal, oil, alternative fuels
Mercury and its Compounds - Pulp and Paper	yes	wood, recycled paper, papermaking additives	wood fuel, coal, oil, alternative fuels, kraft pulping chemicals
Methanol - Pulp and Paper	yes	not generally	printing inks, solvents, anti-freeze, methanol-based chlorine dioxide generation systems
Methyl Ethyl Ketone - Pulp and Paper	yes	not generally	solvents
Methyl Isobutyl Ketone - Pulp and Paper	yes	not generally	not generally
Naphthalene - Pulp and Paper	yes	not generally	solvents on paper machine, deinking chemicals
n-Hexane - Pulp and Paper	yes	not generally	not generally
Nickel and its Compounds - Pulp and Paper	yes	not generally	wood fuel, coal, oil, alternative fuels
Oxides of Nitrogen - Pulp and Paper	yes	not applicable	not applicable
Phenol - Pulp and Paper	yes	glues, resins, coatings	not generally
Phosphorus (Total) - Pulp and Paper	yes	not generally	wastewater treatment nutrients, wood fuel, coal, oil, alternative fuels

PM10 - Pulp and Paper	yes	not applicable	not applicable
PM2.5 - Pulp and Paper	yes	not applicable	not applicable
Polycyclic Aromatic Hydrocarbons - Pulp and Paper	yes	not generally	degreasing agents
Propionaldehyde - Pulp and Paper	yes	not generally	not generally
Selenium and its Compounds - Pulp and Paper	yes	wood, recycled paper	wood fuel, coal, oil, alternative fuels
Sulphur Dioxide - Pulp and Paper	yes	not applicable	not applicable
Sulphuric Acid - Pulp and Paper	yes	not generally	chlorine dioxide generation, pH control, ion exchange resin generation, tall oil acidulation, effluent system neutralization
Toluene - Pulp and Paper	yes	not generally	solvents, kerosene
Total Particulate Matter - Pulp and Paper	yes	not applicable	not applicable
Total Reduced Sulphur - Pulp and Paper	yes	not generally	not generally
Volatile Organic Compounds - Pulp and Paper	yes	not applicable	not applicable
Zinc and its Compounds - Pulp and Paper	yes	not generally	chlorides and sulphates used for water treatment

Annex 2: Data Quality Assessment Procedure

This data quality assessment is based on the guidance on data quality assessment (DQA) for life cycle inventory data provided by US EPA[12] . Quality of the data shall be assessed in the inventory analysis phase at both technosphere flow levels and processes levels, using the data quality indicators shown in Table 4 and Table 5 respectively.

Table 4 Data Quality Pedigree Matrix – Technosphere Flow Indicators

Highest score ← → Lowest score

Indicator		1	2	3	4	5 (default)
Flow reliability		Verified[1] data based on measurements	Verified data based on a calculation or non-verified data based on measurements	Non-verified data based on a calculation	Documented estimate	Undocumented estimate
Flow representativeness	**Temporal correlation**	Less than 3 years of difference[2]	Less than 6 years of difference	Less than 10 years of difference	Less than 15 years of difference	Age of data unknown or more than 15 years
	Geographical correlation	Data from same resolution and a related area of study[3]	Within one level of resolution and a related area of study	Within two levels of resolution but a related area of study	Outside of two levels of resolution	From a different or unknown area of study
	Technological correlation	All technology categories[4] are equivalent	**Three** of the technology categories are equivalent	**Two** of the technology categories are equivalent	**One** of the technology categories is equivalent	**None** of the technology categories are equivalent
	Data collection methods	Representative data from >80% of the relevant market[5], over an adequate period[6]	Representative data from 60-79% of the relevant market , over an adequate period or representative data from >80% of the relevant market, over a shorter period of time	Representative data from 40-59% of the relevant market, over an adequate period or representative data from 60-79% of the relevant market, over a shorter period of time	Representative data from <40% of the relevant market, over an adequate period of time or representative data from 40-59% of the relevant market, over a shorter period of time	Unknown or data from a small number of sites and from shorter periods

Notes: 1 Verification may take place in several ways, e.g. by on-site checking, by recalculation, through mass balances or cross-checks with other sources. For values calculated from a mass-balance or another verification method, an independent verification method must be used in order to qualify the value as verified.
2 Temporal difference refers to the difference between date of data generation and the date of representativeness as defined by the scope of the project
3 A related area of study is defined by the user and should be documented in the geographical metadata. The relationship established in the metadata of the unit process should be consistently applied to all flows within the unit process. Default relationship is established as within the same hierarchy of political boundaries (e.g. Denver is within Colorado, is within the USA, is within North America)
4 Technology categories are process design, operating conditions, material quality, and process scale.
5 The relevant market should be documented in the DQG. The default relevant market is measured in production units. If the relevant market is determined using other units, this should be documented in the DQG. The relevant market established in the metadata should be consistently applied to all flows within the unit process.
6 Adequate time period can be evaluated as a time period long enough to even out normal fluctuations. The default time period is 1 year, except for emerging technologies (2-6 months) or agricultural projects >3 years.

[12] See https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=321834

Table 5 Data Quality Pedigree Matrix – Process Indicators

Highest score ← → Lowest score

Indicator	1	2	3	4	5 (default)
Process review	Documented reviews by a minimum of two types[1] of third party reviewers	Documented reviews by a minimum of two types of reviewers, with one being a third party	Documented review by a third party reviewer	Documented review by an internal reviewer	No documented review
Process completeness	>80% of determined flows have been evaluated and given a value	60-79% of determined flows have been evaluated and given a value	40-59% of determined flows have been evaluated and given a value	<40% of determined flows have been evaluated and given a value	Process completeness not scored

A minimum score of 3 must be received for each of the technosphere flow indicators and process indicators. See Edelen and Ingwersen (2016) for more details on the data quality assessment guidelines.

Annex 3: Accounting for Freshwater Consumption

DEFINITION OF FRESHWATER CONSUMPTION

This PCR document requires the reporting of several categories of "Material resources consumption", one of which is called "freshwater". ISO 14046: Environmental management - Water footprint - Principles, requirements and guidelines defines "water consumption" as a specific type of water use with the following definition:

Water consumption: *"...water removed from, but not returned to, the same drainage basin. Water consumption can be because of evaporation, transpiration, integration into a product, or release into a different drainage basin or the sea. Change in evaporation caused by land-use change is considered water consumption (e.g. reservoir)."*

ISO 14046 further defines freshwater as follows:

Freshwater: *"water having a low concentration of dissolved solids"*

Note 1 to entry: Freshwater typically contains less than 1 000 mg/l of dissolved solids and is generally accepted as suitable for withdrawal and conventional treatment to produce potable water.
Note 2 to entry: The concentration of total dissolved solids can vary considerably over space and/or time.

It follows then that **freshwater consumption is the use of potentially potable water that results in evaporation, transpiration, integration into a product, or the release into a different drainage basin or the sea.**

Water use that is not freshwater (i.e. seawater, brackish water, or other non-potable sources) and water use in which the water either not-removed from the water body[13] (in-stream use) or returns to the same drainage basin from which it originated – are not considered freshwater consumption. Groundwater that is extracted, used for processing, treated and returned to nearby surface water, is not considered freshwater consumption.

RULES AND GUIDANCE TO ACCOUNT FOR FRESHWATER CONSUMPTION

Rules
The following rules shall apply to the calculation of freshwater consumption under this PCR document.

1) In all cases that water is used and it is unknown whether the water is freshwater; the water used is assumed to be freshwater.
2) In all cases that freshwater or assumed freshwater is used and it is unknown whether the water is returned to the same drainage basin, the water use is accounted as freshwater consumption.
3) The moisture content in the primary wood product and all consumed biomass is accounted as water consumption. Moisture content in co-products is allocated on a mass basis and is thus not included under water consumption in the primary product EPD.

[13] e.g., lakes, rivers, groundwaters, seas, icebergs, glaciers and reservoirs

Guidance

Accounting for freshwater consumption is challenging in LCA because current LCI databases include both in-stream and other non-consumptive water use with ambiguous terminology. The following guidance should be applied to separate freshwater consumption from other types of water use:

Excluding in-stream water use: The USLCI database does not account for any in-stream water use. Ecoinvent does account for in-stream water use (at hydroelectric turbines). It is recommended to exclude elementary life cycle inventory flows such as "water, turbine use, unspecified origin (m^3)" in the calculation of freshwater consumption.

Excluding water withdrawals that are not consumption: The USLCI and ecoinvent databases both account for water withdrawal but do not always consider the fate of that water and whether it is consumed, or returns to the originating drainage basin. It is thus recommended that in the development of the life cycle inventory, that primary data collection includes both the inputs of freshwater into the product system as well as the output flows of water into drainage systems that flow into water treatment facilities. Water that is known to be flowing into collection systems is thus excluded from the calculation of water consumption as it is assumed that the treatment facility returns the water to the originating drainage basin. Water that is not collected and treated but is known to re-enter the drainage basin directly (i.e. returned to reservoirs, streams, or groundwater) may be excluded from the calculation of water consumption if the portion of this water that is evaporated is specifically accounted for and documented. All evaporated water is included in freshwater consumption.