

Product-Category Rules (PCR)
for Preparing an Environmental Product
Declaration (EPD) for
Post-Consumer Recycled PET Bottle Content Yarn
PCR 2014:1.0

FAR EASTERN NEW CENTURY CORPORATION

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1. General Information

This document is to be used as the product category rules (PCR) for the manufacturing of post-consumer recycled PET bottle content yarn ("product") globally. This PCR covers products with the following Harmonized System (HS) Codes: 540220,540233,540244,540246,540247,540252,540262. The requirements specified in this PCR are intended to be used for EPDs certified in accordance with the ISO 14025 standard. This document shall be valid until December 31, 2017.

This PCR was first drafted by the Far Eastern New Century Corporation. Representatives from major Taiwanese manufacturers of similar products and stakeholders were invited by the Taiwan Man-made Fiber Industries Association to the open consultation meeting held on November 18, 2014, to participate in the discussion and review of this PCR. The Environment and Development Foundation (EDF) subsequently reviewed and approved this PCR.

For further information and comments concerning this PCR, please contact: Far Eastern New Century Corporation Polyester business plant, Mr. Siman Huang (tel:886-3-5882511 ext. 2006 , fax:886-3-5884200 , email : siman@cfp.fenc.com).

2. Company and product description

The EPD shall include information about the manufacturing company/organization. The information may include manufacturing process related information, and environmental related information, such as the environmental management system information. The information may also include special issues which the company/organization would like to emphasize, such as the products meeting certain environmental criteria, or environmental safety and health related information.

This PCR is applicable mainly to business-to-business (B2B) communications. During the inventory of product related environmental impacts, the scope of inventory shall cover both the product and its packaging.

2.1 Product group function

The post-consumer recycled PET bottle content yarn ("product") as defined in this PCR, is a product made of recycled PET bottles as the main raw material. During the product manufacturing process, the recycled PET bottles are first made into bottle flakes, then converted into plastic chips. Subsequently, the chips are made into products including the pre-oriented yarn (POY), spin- drawn yarn (SDY), and high-oriented yarn (HOY) through the spinning process. The products can then be further processed into draw-textured yarn (DTY), fully-oriented yarn (FOY) and air-textured yarn (ATY), which are widely used in clothing, furniture, and industrial applications.

2.2 Product components/compositions

The products covered in this PCR are post-consumer recycled PET bottle content yarn made of 100% recycled PET bottles. The main compositions/components of the product include:

- Main raw material: recycled PET bottle flakes
- Additives: e.g., titanium dioxide (TiO₂), functional masterbatch, masterbatch, cationic dyeable polyester monomer (SIPE), flame retardants, spinning oil, cheese oil, etc.
- Packaging materials: e.g., wood pallets, plastic pallets, packing tape, cardboard, cartons, etc.

The data quality requirements for the main components/materials are described in Section 9 on calculation rules and data quality requirements.

2.3 Product technical description

The product technical description part of the EPD may include but not limited to the following information:

- Denier
- Melting Point
- Tenacity)
- Elongation (%)
- Color
- Other (e.g., appearance, dyeability, etc.)

3. List of materials and chemical substances

The contents of the following materials and substances in the product shall be declared:

- All materials of the product (excluding packaging material) with weight ratio (material weight/product weight (excluding packaging)) $\geq 1\%$;
- All materials of the packaging with weight ratio (material weight/packaging weight) $\geq 1\%$;
- All substances/materials in the product restricted/regulated by legal and customer requirements.

For example:

1. Free formaldehyde content test
2. Banned azo dyes: content shall not exceed 30 ppm
3. Test on banned dyes
4. Test on contents of cadmium, lead, antimony, tin and other heavy metals
5. Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) content test
6. Alkyl phenol ethoxylates (APEO) content test
7. Plasticizer content test

The declaration of relevant information may only be made when appropriate evidences are available (for example, test reports from accredited laboratories/testing facilities). The following organizations may provide accreditation for testing facilities: Taiwan Accreditation Foundation (TAF), (Asia Pacific Laboratory Accreditation Cooperation (APLAC), International Laboratory Accreditation Cooperation (ILAC) or ILAC Mutual Recognition Arrangement (ILAC MRA). For definitions of testing methodology and confirmations of regulated hazardous substances based on the accredited laboratories' product testing methods, please refer to IEC 62321 Standard.

4. Declared unit

The declared unit is one (1) kilogram (kg) of post-consumer recycled PET bottle content yarn. The reason for adopting this unit is that the product is sold by its weight in kilogram.

5. System boundaries

The main system boundaries for the declared product system are presented as follows:

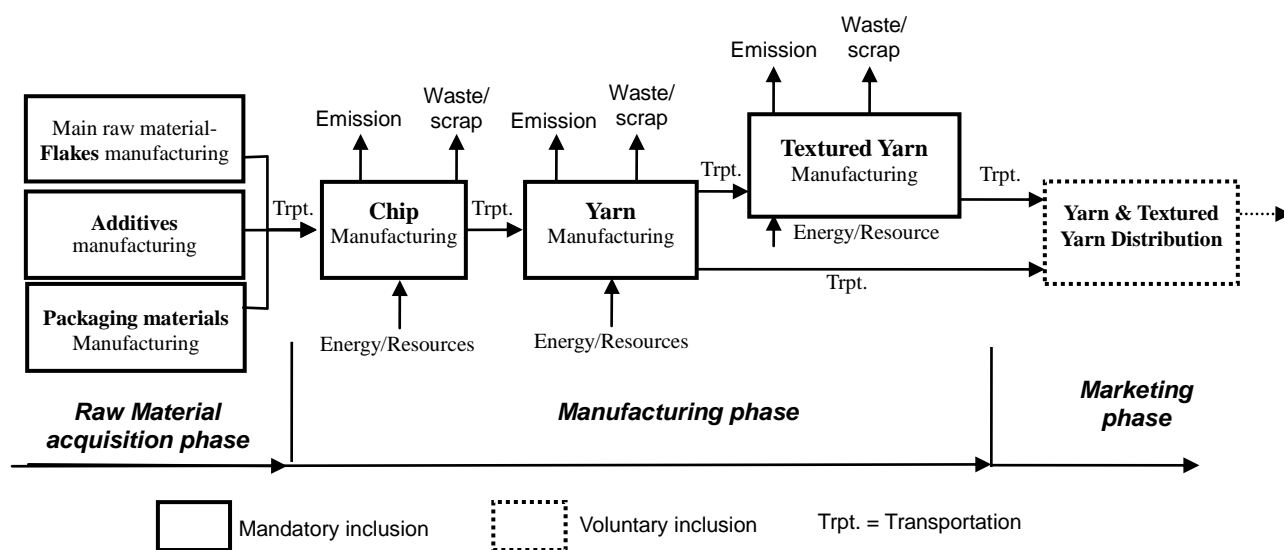


Figure 1 System boundary of the product system

As noted in Figure 1 above, the life cycle of the product covers three life cycle stages: raw material acquisition, product manufacturing, and distribution. The data quality requirements for the inventory process are described in Section 9 on calculation rules and data quality requirements.

Raw Materials Acquisition Stage

The LCA shall include information for the following unit processes:

- Processes associated with recycling of the product's main material, bottle flakes;
- Processes associated with manufacturing of additives used in the product;
- Processes associated with manufacturing of packaging materials for the product.

Manufacturing Stage

The LCA shall include information related to the manufacturing of the main material of the products (plastic chips and yarns) and yarns from subsequent processing of the products:

- Inputs of energy and resources required during the manufacturing processes; and

- Emissions of air and water pollutants and generation of waste during the manufacturing process; and
- Transportation of process waste to the waste treatment facilities; and
- In-plant transportation.

Distribution and Marketing Stage

The LCA shall include information from the following processes:

- Reporting of information regarding the transportation of products to the distribution sites or distributor designated sites is mandatory;
- Reporting of information regarding transportation from distributors to the customers and waste disposal processes is optional.

5.1 Specification of different boundary settings

Boundary in time

The validity period for the LCA results presented in the LCA report shall be defined.

Boundary towards nature

If the manufacturing processes are located within Taiwan, the solid waste categories as defined in Taiwan's Waste Disposal Act shall be adopted. If the processes are located in other countries, equivalent legal requirements shall be considered.

The natural boundary of the system shall describe the boundary where the materials and energy resources flow from nature into the system, and where the water and air emissions and waste are released out of the system.

Only the quantity of the disposed waste needs to be considered; landfilling process does not need to be considered. If the waste is generated through wastewater treatment or incineration process, such waste should be included into the wastewater treatment or incineration process.

Boundaries in the life cycle

The boundaries in the product life cycle are described in Figure 1. The construction of the site and infrastructure, as well as the production of manufacturing equipment do not need to be included.

Boundaries towards other technical systems

Boundaries towards other technical systems describe the inputs of material and other components towards other systems, as well as outputs of materials towards other systems. For the inputs of recycled materials and energy towards the product manufacturing stage, the transportation between the recycling process and use of recycled materials shall be included in the data set. For the production of recyclable products during the manufacturing stage, the transportation towards the recycling process shall be included.

(Note: Further explanations are provided in Section 7 on open-loop recycling.)

Boundaries regarding geographical coverage

The manufacturing stage may cover manufacturing processes located on any sites around the world. For processes located in a specific region, the data used should be representative of the region. The data for the main constituents shall be the specific regional data for the region where the process takes place (see Section 9). For ease of comparison, no matter where the emissions are generated, the same environmental impact parameters should be used for life cycle impact assessment (see Section 10).

6. Cut-off rules

For any impact category, if the sum of various impacts from a specific process/activity is less than 1% of the impact equivalent in that category, such a process/activity may be neglected during the inventory analysis. Nonetheless, the accumulated impact of neglected process/activity may not exceed 5%. Components and materials omitted from the LCA shall be documented.

(Note: This judgment for this “1% Rule” is based on the environment relevance assessment of material input to the system, and does not consider special and exceptional environmental impacts.)

7. Allocation rules

The main allocation rules shall be valid for the entire product system. For other secondary processes, other allocation rules may be defined; however, the use of these rules should be justified. Product-specific information should be preferentially collected in order to avoid the need for allocation. While selecting allocation rules, the following principles are recommended.

- Multi-output: The allocations are based on the changes in the resource consumption and pollutant emissions (for example, adopted quantity allocation for some main component, or surface allocation for some components), following the changes in the studied system’s output product or function or economical relationship.
- Multi-input: The allocation is based on actual relationship. For example, the manufacturing process’s emissions may be affected by the change in waste flow input.
- Open loop recycling: For the input of recycled materials or energy during the manufacturing stage of the product system, the transportation between the recycling process and the recycling to material use shall be included in the dataset. For the product which shall be recycled during the manufacturing stage, the transportation towards the recycling process shall be included.
- Closed loop recycling: For materials from the product system that are being recycled and reused within the same product system, the recycling ratio shall be considered to avoid double counting. The transportation and energy inputs from the recycling process to the reuse of materials shall be included in the dataset. For the product which shall be recycled during the manufacturing stage, the transportation towards the recycling process shall be included.

Notes:

- *Allocation may be avoided through avoidance of dividing processes, for example as described in*

Section 6.3 of ISO/TR 14049; or through expansion of system boundary (for example as described in Section 6.4), so that the amended system shares the same product exchanges as the original system.

8. Units

The base units and derived units of the International System of Units (SI, *Système International d'unités*) shall be used preferentially.

Power & energy units:

- power unit: W
- energy unit: J

Specification units:

- length unit: m
- capacity unit: m³
- area unit: m²
- weight unit: kg

If necessary, prefixes may be used before the SI units:

- 10⁹ = giga, symbol “G”
- 10⁶ = mega, symbol “M”
- 10³ = kilo, symbol “k”
- 10⁻² = centi, symbol “c”
- 10⁻³ = milli, symbol “m”
- 10⁻⁶ = micro, symbol “μ”
- 10⁻⁹ = nano, symbol “n”

9. Calculation rules and data quality requirements

Data quality requirements for the raw material acquisition stage

- Site specific data shall be used for the processes related to the manufacturing and transportation of the product's main material, bottle flakes, including the recycling process (collection and pre-treatment) and reuse process (shredding and recycling) for the first-tier suppliers. If other types of information are used, description of the information and rationale for using such information shall be provided.
- Generic data may be used for information regarding the additives and packaging of the products. Please refer to Appendix I for the common sources of generic data used internationally.

Data quality requirements for the manufacturing stage

- Generic data may be used for manufacturing of the plastic chips. Please refer to Appendix I for the common sources of generic data used internationally.

- Site specific data shall be used for the product manufacturing processes. If other types of information are used, description of the information and rationale for using such information shall be provided. Site specific data from a representative manufacturing plant may be used in place of site specific data for main raw materials.
- Site specific data shall be used for the manufacturing of yarns further processed from the product. If other types of information are used, description of the information and rationale for using such information shall be provided.
- Generic data may also be used for manufacturing of the products' additives and packaging materials, based on their actual consumption as the basis of calculation. Please refer to Appendix I for the common sources of generic data used internationally.
- When generic data are used, the equivalence between the chemical and/or physical process, as well as the technology and system boundaries of the referred generic system with the declared product system shall be considered. Moreover, it is also recommended to consider the date or geographic aspects of the data quality when feasible.
- Generic data may also be used when suppliers refuse to provide specific data, or when even if generic data are used in place of specific data, there is only minor impact to the results. The general rule is that if generic data are used in place of specific data, their combined contribution for all life cycle stages shall not be greater than 20% of total impacts for each impact category. But there may be certain exception to specific products, and such exceptions shall be explained.
- The data shall be representative for the average of a specific year. If the average data for a specific year cannot be obtained, the average data for a specific time period may be used, the data shall be representative, and the reason for using such data shall be provided.
- The electricity mix for the manufacturing stage should be site specific data. If site specific data cannot be obtained, the official electricity mix for the country where the site is located may be used as approximate value. The electricity mix shall be documented.
- For the definition of hazardous waste, the definition as defined in Taiwan's Waste Disposal Act shall be used for sites located in Taiwan. For sites located outside Taiwan, legal requirements for the host country shall be observed.
- For transportation of main raw materials to the manufacturing plant, the actual transportation modes used and distance traveled shall be considered.

Data quality requirements for the distribution and marketing stage

- For transportation of products to the distributors or points-of-sales, the actual mode of transportation and distance traveled shall be considered.

10. Parameters to be declared in the EPD

The following parameters shall be declared in the EPD:

Resource use

- non-renewable resources
 - materials resources
 - energy resources (used for energy conversion purposes)

- renewable resources
 - material resources
 - energy resources (used for energy conversion purposes)
- secondary resources
 - material resources (pre-consumer or post-consumer recycling and reuse)
 - energy resources (used for energy conversion purposes)
- recovered energy flows (such as thermal energy) expressed in MJ
- water use divided into:
 - total amount of water (consider make-up water for in-plant recycling and reuse)
 - direct amount of water used by the core process

The following requirements on the resource declaration also apply:

- all parameters for resource consumption shall be expressed in mass, with the exception of renewable energy; resources used for the generation of hydroelectric, wind electricity and solar energy, which shall be expressed in MJ;
- all parameters shall not be aggregated but reported separately. Resources which contribute for less than 5% in each category shall be included in the resources list as “other”;
- nuclear power shall be reported among the non-renewable energy resources as kg of uranium calculated by converting the thermal energy (MJ) considering a reactor of III generation with an efficiency of 33%;
- the PCR can define other resources (for example rare materials originating from the LCI data) which may be listed and detailed in the EPD for each specific product category;
- the energy content into some products (such as paper or plastic based products) is useful information for the end of life management. For this reason, the “energy content of product” shall be declared in MJ: its estimation shall be made considering the gross calorific value of the product. Only the energy that is suitable for an eventual energy recovery at the end of life shall be considered (energy content of steel due to its carbon content for example shall not be considered since it is not practically recoverable);
- energy content of biomass used for feed or food purposes shall not be considered.

Impact equivalents expressed as potential environmental impacts

The potential environmental impacts associated with the various types of use of resources and pollutant emissions shall be reported into the following impact categories:

- Emission of greenhouse gases (expressed as the sum of global warming potential, GWP, 100 years, in CO₂ equivalents).
- Emission of acidifying gases (expressed as the sum of acidifying potential in sulphur dioxide (SO₂) equivalents).
- Emission of gases that contribute to the creation of ground-level ozone (expressed as the sum of ozone-creating potential, ethene-equivalents).
- Emission of substances to water contributing to oxygen depletion (expressed as phosphate (PO₄) equivalents).

Impact categories for optional declaration

- Emission of ozone-depleting gases (expressed as the sum of ozone-depleting potential in mass of CFC 11-equivalents, 20 years).

Waste

- hazardous waste (as defined in Taiwan's Waste Disposal Act, or follow host countries' laws for sites outside Taiwan).
- non-hazardous waste

Note: For characterization factors of each impact category, please refer to *General Programme Instructions For The International EPD System, Version 2.01 (2013-09-18)*.

11. Recycling information

If practical, information for the constituents/components which can not be recycled and therefore should be disposed of properly during the end-of-life stage may also be included.

Recycling marking for product's plastic components and plastic packaging material (optional information):

- Plastic parts marking: Where technologically possible, plastic parts of the product weighing ≥ 25 g shall be marked in accordance with the ISO 11469 and ISO 1043 Part 1/2/3/4, SPI or other international standard label to facilitate their identification and recovery at the end of life.
- Plastic packaging material marking: The Plastic packaging materials shall be labeled on the parts with SPI or other international standards for ease of sorting.

12. Other environmental information (Optional)

The EPD may cover information including technology adopted, site of product manufacturing and assembly, as well as information on other working environment, health and risk-related aspects.

If this PCR is to be used for product carbon footprint declaration purpose, in the declaration, information regarding commitment on GHG reduction should be included and shall ensure that the commitment is measurable, reportable and verifiable. The organization may also list environmental and energy management related information, such as awards, commendations and system certifications (e.g., ISO 14001, ISO 14064-1, IECQ HSPM) etc.

13. Information about the certification

The information on PCR review, EPD verification and verification organization shall be included.

EPD Certification is valid until 20XX-__-__

According to the Requirements for the international EPD system, *General Programme Instructions, Version 2.01 (2013)* – www.environdec.com.

The PCR review for _____ (PCR 2014:) was administered by the Environment and Development Foundation and carried out by an LCA expert panel chaired by Dr. Wen-Ching Chen (wencc@edf.org.tw).

Independent verification of the declaration, according to ISO 14025:2006

☐ Internal ☒ External

Third party verifier: Environment and Development Foundation in Taiwan.

Accredited by :

Name:

Title:

Organization:

Signature:_____

Name:

Title:

Organization:

Signature:_____

Name:

Title:

Organization:

Signature:_____

Environmental declarations from different programmes may not be comparable.

14. References

The EPD shall refer to the following documents:

- GENERAL PROGRAMME INSTRUCTIONS FOR THE INTERNATIONAL EPD® SYSTEM, Version 2.01 (2013-09-18), downloadable from:
http://www.environdec.com/Documents/GPI/General_programme_instructions_2_01_20130918.pdf
- Relevant PCR documents
- The underlying LCA report

When available, the following documents shall also be referenced:

- **Other documents and recycling instructions that verify and complement the EPD.**

Appendix I – Generic Data Sources to Refer to

For processes located within Taiwan, Taiwan generic data or the data published by the commercial, industrial and energy competent authorities of the Republic of China (ROC) government, may be used. However, for other regions (such as EU), if there are more relevant generic data available, these data should be used instead. When data from the following generic databases are used, the most current and updated data should be used.

| Material | Database |
|---|--|
| Packing materials, transport, Waste treatments | BUWAL 250 |
| Steel, Primary copper, Copper products, Electricity, Fuels, Aluminum, Chemicals, Transports, Waste management | ELCD |
| | EIME (Environmental Information and Management Explorer) EcoBilan |
| Plastics | PE Plastics Europe (Association of Plastics Manufacturers in Europe) |
| | ELCD |
| | EIME (Environmental Information and Management Explorer) EcoBilan |
| Electronic components | ELCD |
| | EIME (Environmental Information and Management Explorer) EcoBilan |
| General Database | Ecoinvent |
| | The Boustead Model |
| | PE-GaBi |
| | DoITPro(Taiwan) |

Appendix II – Reporting Format for the EPD

This appendix provides guidance information for the titles of sections, types of data and required information to be reported in the mandatory reporting part of the EPD. As a generic reporting template, the following titles and sub-titles are recommended:

(Refer to the PCR manual for the section numbering, the information in Italics are the recommended data/information for inclusion)

Introductory part

Each EPD should have an introduction part on the top part of the EPD which includes the following information:

- *Company/organization name*
- *Product name*
- *EPD registration number*

Description of the company/organization and product/service

Company/Organization

- *Description of company/organization*
- *Description of overall working environment, existing quality system and environmental management system*

Product and services (see Section 2)

- *Product's main applications*
- *Description of product specification, manufacturing process, manufacturing sites (if there are several sites)*
- *For product's environmental performance aspects, characteristics which may improve the usefulness of product*
- *Other types of relevant information, for example, special manufacturing processes with special advantages to the environment*

List of materials and chemical substances

- *Content declaration (see Section 3)*

Presentation of the environmental performance

- *Outline of the LCA methodology, for example, period of LCA, declared units, system boundaries (graphical presentation), cut-off and allocation rules, and data sources.*

Manufacturing stage (see Section 10)

Use stage (see Section 10)

- *Geographical region for product delivery*
- *Transportation data*
- *End-of-life information*

Information about Company and Certification Organization

Recycling information (see Section 11)

Other environmental information (see Section 12)

Information regarding certification (see Section 13)

- *Names of certification and verification organizations*
- *Validity of certification certificates*
- *Compliance with legal and relevant requirements*

References (see Section 14)

- *relevant PCR documents*
- *EPD General Program Instructions, Version 1.0 (2008-02-29)*
- *underlying LCA study*
- *other supporting documents for LCA information*
- *other relevant documents regarding company/organization's environmental activities*

Appendix III Abbreviations

| Acronym | Common Name |
|----------|--|
| APLAC | Asia Laboratory Accreditation Cooperation |
| CFP | Carbon Footprint of Product |
| EPD | Environmental Product Declaration |
| ILAC | International Laboratory Accreditation Cooperation |
| ILAC MAR | International Laboratory Accreditation Cooperation Mutual Recognition Arrangement |
| ISO | International Organization for Standardization |
| LCA | Life Cycle Assessment |
| PCR | Product Category Rule |
| TAF | Taiwan Accreditation Foundation |
| TEC | Typical Energy Consumption |
| Trpt | Transportation |
| POY | Pre-Oriented Yarn |
| SDY | Spin Drawn Yarn |
| HOY | High Oriented Yarn |
| DTY | Draw Textured Yarn |
| FOY | Fully-orientated yarn |
| ATY | Air-Textured Yarn |

Appendix IV Participants of Stakeholders Consultation Meeting

The following manufacturers and organizations participated in the stakeholders consultation meeting held on November 18, 2014.

1. LEALEA ENTERPRISE CO., LTD.
2. CHUNG SHING TEXTILE MARKETING CO., LTD.
3. TAIWAN MAN-MADE FIBER INDUSTRIES ASSOCIATION
4. TAIWAN TAFFETA FABRIC CO., LTD.
5. HONG YI FIBER IND. CO., LTD.
6. EVEREST TEXTILE CO., LTD.
7. YI JING INDUSTRIAL CO., LTD.
8. TOUNG LOONG TEXTILE MFG.
9. NAN YA PLASTICS CORPORATION
10. ZIG SHENG INDUSTRIAL CO., LTD.
11. SHINKONG SYNTHETIC FIBERS CORPORATION
12. FAR EASTERN NEW CENTURY CORPORATION
13. YI TONG FIBER CO., LTD.
14. LAN FA TEXTILE CO., LTD.