PRODUCT CATEGORY RULES (PCR)
DATE 2024-02-27

MACHINE-TOOLS FOR DRILLING, BORING OR MILLING METALS AND COMPOSITE MATERIALS

PRODUCT CATEGORY CLASSIFICATION: UN CPC 44214

PCR 2012:02
VERSION 4.0.0

VALID UNTIL 2028-02-27

TABLE OF CONTENTS

1 INTRODUCTION

This document constitutes Product Category Rules (PCR) developed in the framework of the International EPD System: a programme for type III environmental declarations[1] according to ISO 14025:2006, ISO 14040:2006, ISO 14044:2006, and product-specific standards such as EN 15804 and ISO 21930 for construction products. Environmental Product Declarations (EPD) are voluntary documents for a company or organisation to present transparent, consistent and verifiable information about the environmental performance of their products (goods or services).

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

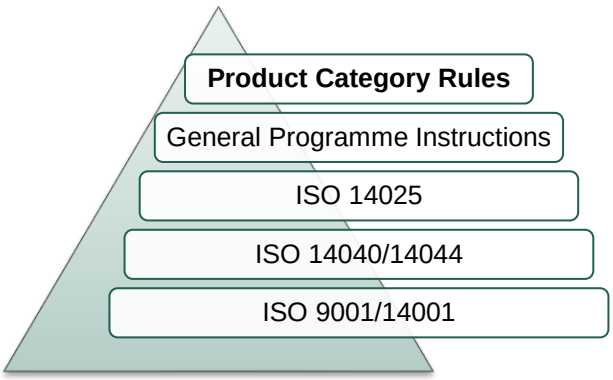

Figure 1 The hierarchy between PCRs, standards and other documents.

Within the present PCR, the following terminology is adopted:

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

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

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

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

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

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

2 GENERAL INFORMATION

2.1 ADMINISTRATIVE INFORMATION

Name:	Machine-tools for drilling, boring or milling metals and composite materials	
Registration number and version:	PCR 2012:02, version 4.0.0	
Programme:	The International EPD System	
Programme operator:	EPD International AB, Box 210 60, SE-100 31Stockholm, Sweden. Website:www.environdec.com E-mail:info@environdec.com	
PCR Moderator:	Eva Martínez Herrero, Fundación Centro Tecnológico de Miranda de Ebro (CTME), Spain, evamtz@ctme.es	
PCR Committee:	Knowledge transfer played a key role in developing this PCR. It was prepared by CTME as LCA expert and Grupo Nicolás Correa as machine-tool manufacturer.	
	Grupo Nicolás Correa Alcalde Martín Cobos, 16ª 09007 Burgos. (Spain)	
	CTME Polígono Industrial de Bayas C/ Montañana R60/61 09200 Miranda de Ebro (Spain)	
Date of publication and last revision:	2024-02-27 (version 4.0.0) See Section 8 for a version history of the PCR.	
Valid until:	2028-02-27	
Schedule for renewal:	A PCR is valid for a pre-determined time period to ensure that it is updated at regular intervals. When the PCR is about to expire, the PCR Moderator shall initiate a discussion with the Secretariat on how to proceed with updating the PCR and renewing its validity. A PCR may also be updated without prolonging its period of validity, provided significant and well-justified proposals for changes or amendments are presented. See www.environdec.com for the latest version of the PCR. When there has been an update of the PCR, the new version should be used to develop EPDs. The old version may however be used for 90 days after the publication date of the new version, as long as the old version has not expired.	
Standards conformance:	General Programme Instructions of the International EPD System, version 4.0, based on ISO 14025 and ISO 14040/14044	

PCR language(s):	At the time of publication, this PCR was available in English. If the PCR is available in several languages, these are available at www.environdec.com.In case of translated versions; the English version takes precedence in case of any discrepancies.

2.2 SCOPE OF PCR

2.2.1 PRODUCT CATEGORY DEFINITION AND DESCRIPTION

This document provides Product Category Rules (PCR) for the assessment of the environmental performance of *machine tools for drilling, boring or milling metals and composite materials* and the declaration of this performance by an EPD.

The products included in this PCR are machines tools. In accordance with the standard ISO 14955-1:2017, adapting it to milling processes, machine-tool is mechanical device which is fixed (i.e., not mobile) and powered (typically by electricity and compressed air), typically used to process workpieces by selective removal of material. Machine tools operation can be mechanical, controlled by humans or by computers. Machine tools may have a number of peripherals used for machine tool cooling/heating, process conditioning, workpiece and tool handling (workpiece feeding excluded), recyclables and waste handling and other tasks connected to their main activities.

Examples of included machines tools are:

- Turning machine
- Drilling machine
- Milling machine
- Boring machine
- Shaping machine
- Reaming machine
- Sawing machine
- Filling machine
- Brushing machine

The manufacturing processes classified according to DIN 8580 (2003-09), which are typically performed by these machine tools are:

- 3. Cutting
    - 3.1 Severing
        - 3.2 Chip removal/cutting with geometrically well-defined tools edges
            - 3.2.1 Turning
            - 3.2.2 Drilling, countersinking ad counterboring, reaming
            - 3.2.3 Milling
            - 3.2.4 Planing, shaping
            - 3.2.5 Broaching
            - 3.2.6 Sawing
            - 3.2.7 Filing, rasping
            - 3.2.8 Machining with brush like tools
            - 3.2.9 Scraping, chiselling

On the one hand, the specification of the product could be based on one standard configuration with or without accessories[2]. On the other hand, based on the modular rationalization of milling machines families, the product could be defined as the sum of the structural/functional modules[3] (MOD's) and optional accessories (ACS').

The machine-tools for drilling, boring or milling metals included in this PCR are defined by the UN CPC group 44214. The hierarchical structure is:

- Section: 4 - Metal products, machinery and equipment
  - Division: 44 - Special-purpose machinery
    - Group: 442 - Machine-tools and parts and accessories thereof
      - Class: 4421 - Machine-tools for working metal; machine-tools for working any material by laser or similar process
        - **Subclass: 44214 - Machine-tools for drilling, boring or milling metal**

For more information see http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=25.

There is no applicable UN CPC code for machine-tools for drilling, boring or milling composite materials.

The product group and UN CPC code (if available) shall be specified in the EPD.

2.2.2 GEOGRAPHICAL SCOPE

This PCR may be used globally.

2.2.3 EPD VALIDITY

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

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

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

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

[2]Accessories are auxiliary elements. Their incorporation into a standard configuration does not alter the primary function of material removing, just provide secondary operations as tool change, chips removal, etc. They are equipment that have a significant sale and are included in the sales catalogue of the machines.

[3]Modules are structural elements; some combinations offer the capability of material removing. Each reconfiguration (RECONF) constitutes a standard machine. Therefore, standard machines are defined as configurations provided to customers to remove material.

3 PCR REVIEW AND BACKGROUND INFORMATION

This PCR was developed in accordance with the PCR development process described in the GPI of the International EPD System, including open consultation and review.

3.1 OPEN CONSULTATION

3.1.1 VERSION 1.0

This PCR was available for open consultation from 2011-03-02 until 2011-04-14, during which any stakeholder was able to provide comments by posting on the PCR forum on www.environdec.com or by contacting the PCR moderator.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders.

3.1.2 VERSION 2.0

This PCR was available for open consultation from 2014-03-19 until 2014-05-19, during which any stakeholder was able to provide comments by posting on the PCR forum on www.environdec.com or by contacting the PCR moderator.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders.

3.1.3 VERSION 3.0

This PCR was available for open consultation from 2018-05-23 until 2018-07-23, during which any stakeholder was able to provide comments by posting on the PCR forum on www.environdec.com or by contacting the PCR moderator.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders.

3.1.4 VERSION 4.0.0

This PCR was available for open consultation from 2022-09-22 until 2022-11-22, during which any stakeholder was able to provide comments by contacting the PCR Moderator and/or the Secretariat.

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

3.2 PCR REVIEW

3.2.1 VERSION 1.0 AND 2.0

Previous versions of the PCR were reviewed by the Technical Committee of the International EPD System.

3.2.2 VERSION 3.0

PCR review panel:	The Technical Committee of the International EPD System. A full list of members is available at www.environdec.com. The review panel may be contacted via info@environdec.com. Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review.
Chair of the PCR review:	Maurizio Fieschi
Review dates:	2018-08-22 until 2018-10-12

3.2.3 VERSION 4.0.0

PCR review panel:	The Technical Committee of the International EPD System. A full list of members is available at www.environdec.com. The review panel may be contacted via info@environdec.com. Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review.
Chair of the PCR review:	Barbara Nebel
Review dates:	2023-01-25 until 2023-05-25

3.3 EXISTING PCRS FOR THE PRODUCT CATEGORY

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

- International EPD System. www.environdec.com.
- UL Environment , www.ul.com
- JEMAI CFP Program, www.cfp-japan.jp/english/list
- JEMAI EcoLeaf, www.ecoleaf-jemai.jp/eng/pcr.html
- ADEME, https://base-empreinte.ademe.fr/
- NSF, www.nsf.org/standards-development/product-category-rules
- EPD Norge, www.epd-norge.no/pcr-register/category353.html
- Global EPD, www.aenor.com/certificacion/certificacion-de-producto/declaraciones-ambientales-de-producto/declaraciones-globalepd-en-vigor
- European Commission Product Environmental Footprint (PEF).

No existing PCRs with overlapping scope were identified.

Table 1 Existing PCRs and other internationally standardized methods that were considered to avoid overlap in scope and to ensure harmonisation with established methods.

NAME OF PCR/STANDARD	PROGRAMME/ STANDARDISATION BODY	REGISTRATION NUMBER, VERSION NUMBER/DATE OF PUBLICATION	SCOPE
Machine-tools for material working by removal of material	International EPD System	2021:10 version 1.0.3	Machine-tools for working any material, by laser or similar

3.4 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed to enable publication of EPDs for this product category based on ISO 14025, ISO 14040/14044. The PCR enables different practitioners to generate consistent results when assessing the environmental impact of products of the same product category, and thereby it supports the comparability of products within a product category.

In addition, this PCR is a consolidated document at the technological and methodological levels. Knowledge transfer plays a key role in developing this instrument since 2012, incorporating consistently updated information.

3.5 UNDERLYING STUDIES USED FOR PCR DEVELOPMENT

The methodological choices made during the development of this PCR (declared/functional unit, system boundary, allocation methods, impact categories, data quality rules, etc.) were primarily based on the following underlying studies:

- Martínez Herrero, E., Pereda Pereda, L., Huidobro Fernández, F. *et al., 2019.* An environmental evaluation of a milling machine range: a case study on reconfigurable approach. SN Appl. Sci. 1, 1513. https://doi.org/10.1007/s42452-019-1552-7
- Martinez E, 2017. Updating of the life cycle assessment study (LCA) of the compact fixed bed milling machine range, NORMA.

Other references used for PCR development:

- Schiske, K., 2012. Energy-Using Product Group Analysis - Lot 5. Machine tools and related machinery. Sustainable Industrial Policy - Building on the Ecodesign. Directive - Energy-using Product Group Analysis/2. Fraunhofer Institute for Reliability and Microintegration, IZM. http://www.eceee.org/ecodesign/products/machine-tools/
- ISO 14955-1:2017 Machine tools -- Environmental evaluation of machine tools -- Part 1: Design methodology for energy-efficient machine tools.
- Shneor, Y., 2018. Reconfigurable machine tool: CNC machine for milling, grinding and polishing. Procedia Manufacturing 21, 221 –227.
- PCR 2022:09 V 1.0 Presses for working metal product category classification: UN CPC 44217

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

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

4.1 FUNCTIONAL UNIT

A functional unit shall be used according to this PCR. The functional unit shall be defined as the range of services that the machine can provide, including its auxiliary elements or accessories. The functional unit shall be defined as the use of the product during a reference service life (RSL) of 15 years.

The productivity, operational states and the components and accessories of the machine-tool needs to be considered. The operational states shall fulfil the generalized machine tool functions. The machine tool functions shall be assignments specific to each machine tool and correspond to a transition from total energy supplied to the machine tool via machine tool functions and functional mapping to the machine tool component level.

The functional unit above shall be completed with the following information:

- The operating states of the machine tool and their duration in time in the form of a total time diagram (see Section 4.7.2.3).
- The accuracy of machined parts.

To calculate the results per functional unit two further aspects shall be considered and declared in the EPD:

- The expected lifetime production in the RSL.
- The productivity of the machine tool.

When comparing EPDs of machine tools, these parameters shall be considered.

Data on the above parameters should be from final users or, alternatively, from reasonably expected use of the machine. In cases where are all relevant functional aspects are not possible to be defined, e.g. from the point of view of the machine tool manufacturer, the default total time diagram and operating states in Section 4.7.3.3 can be used to.

The reference flow is the machine tool(s) necessary to fulfil the functional unit.

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

The RSL of a product category is the reference time to which the performance of all products of a product category are related to in the functional unit. EPDs based on this PCR shall use RSL of 15 years.

The evaluation of “typical “ use patterns is challenging due to the very different machining cycles in manufacturing processes. The broad spectrum of use patterns includes one or more shifts of operation and permanent or occasional usage. For this PCR, the recommended annual operating for machine tools is 16 h/day (2 operation shifts) x 260 day/year= 4 160 h

The technical/actual lifespan of the machine tool shall also be declared. This is not necessarily the same as the RSL, meaning that the machine tool can be replaced during the RSL (i.e. through retrofitting or revamping see Section 4.7.3.3). If maintenance and retrofitting is necessary to maintain the functionality of the machine tool during the technical/actual lifespan, this shall be declared in the EPD and considered in the modelling the use stage (see more in Section 4.7.3.3)

The EPD shall include specifications of all modules, accessories and reconfigurations under declaration.

The EPD shall state the trade name (if relevant), species and the variety (if relevant) of product shall be declared. The production system shall be specified (i.e. conventional or organic), if relevant.

The EPD shall specify the technical performance and other information on the product as reported in Table 2 and Table 3. The information is mandatory any time they are applicable. If several, similar machines are included in the same EPD, this information shall be specified for each machine.

Table 2 Machine description.

INFORMATION	EXAMPLES/EXPLANATIONS/COMPONENTS/UNIT
Commercial name	As stated in the operating manual and sales catalogues
Head	Universal Manual Head, Universal Auto-indexing Differential Head, Vertical spindle, etc.
Size and dimension	Length (X Axis), width (Y Axis), height (Z Axis) (mm)
Weight	kg
Maximum load on the table	kg
Surface table	mm
Automatic traverses	Longitudinal (mm), cross (mm), vertical (mm)
Type of frame	Bed-type, travelling column, bridge type, rotary table, gantry, high performance gantry
Feeds	Rapid traverses X-Y-X (m/min)
Installed power	W
Level of automation	Automatic (system, cell, centre), semiautomatic (NC Machine), mechanic (Machine)
Machining (machine process, motion and control)	24 V, 230V, E/R module supply, monitoring module, CNC total, pulse lubrication, linear ways
Process conditioning and cooling	Compressed Air, spindle cooling pump
Workpiece handling	Hydraulic pump, cutting fluid jets
Tool handling or die change	Automatic tool changer (units), Hydraulic pump
Recyclables and waste handing	Chip conveyor, mist collector
Security	Full enclosed guarding, work light
Machine cooling/heating	CNC air-conditioning 1, CNC air-conditioning 2, fan E/R module, cooling fan 1, cooling fan 2, spindle cooling pump, fluid application pump, pulse lubrication, electrical cabinet, lifetime lubrication: linear ways, screws of spindles.

Table 3 Technical information.

INFORMATION	UNIT
Functional performance (energy consumption/volume of material removed) under different advances and different sizes of tools	kWh/m^3
Productivity, included head and lighting consumption	kWh/h
Milling head power	kW
Total power	kW
Cutting oil consumption	kg/h
Lubricating oil consumption	kg/h
Wear tools consumption	kg/h

4.3 SYSTEM BOUNDARY

The scope of this PCR and EPDs based on it is from cradle to grave.

4.3.1 LIFE-CYCLE STAGES

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

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

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

4.3.1.1. Upstream processes

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

- Extraction and processing of raw material for all main parts and components,

- Secondary processing of material for main parts and components,
- Recycling processes of secondary materials from other product life cycles,
- Transportation of raw material and commercial products along the upstream supply chain,
- The manufacturing of primary and secondary packaging, if relevant.
- Generation of electricity and production of fuels, steam and other energy carriers used in upstream processes.

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

For modelling of infrastructure and capital goods, see Section 4.3.2

4.3.1.2. Core processes

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

- External transportation of materials and components to manufacturing,
- External transportation from the core processes (e.g. wastes to the landfills),
- Manufacturing process for parts and components
- Internal transports within the manufacturing plant,
- Assembly of the final machine: mechanical assembly, electric/hydraulic installation, soldering,
- Waste treatment of waste generated during manufacturing,
- Maintenance (e.g. of the manufacturing machines),
- Preparation of the final product,
- Generation of electricity and production of fuels, steam and other energy carriers used in core processes.

Core processes not listed may also be included. Manufacturing of a minimum of 99% of the total weight of the declared product including packaging shall be included.

The following processes shall not be included:

- Business travel of personnel,
- Travel to and from work by personnel, and

Research and development activities. For modelling of infrastructure and capital goods, see Section 4.3.2

4.3.1.3. Downstream processes

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

- Transportation from final manufacturing to customer (see 4.10.3),
- Foundation processes,
- Lifetime operation of the product including power losses and emissions (e.g. cutting tools, coolant, ancillary products),
- Ordinary maintenance, replacements of product parts, during the RSL;
- Retrofitting activities including substitution of key parts of the product, which extends the lifespan of the product (if relevant);
- Disassembling of the product,
- Recycling of material after end of life,

End-of-life processes of packaging waste and any wasted part of the product.The potential benefit of recycling and waste treatment of milling machines according to the specified scenarios may be presented in the EPDs, as module D, modelled according to rules in EN 15804. The results of this module shall be separately declared and not included in the total results figure.

For modelling of infrastructure and capital goods, see Section 4.3.2.

4.3.2 INFRASTRUCTURE AND CAPITAL GOODS

In general, the production and end-of-life processes of infrastructure or capital goods[4] used in the product system should not be included within the system boundaries. They may be included when infrastructure and capital goods are known to be relevant in terms of their environmental impact, or when a generic LCI dataset includes infrastructure/capital goods, and it is not possible, within reasonable effort, to subtract the data on infrastructure/capital goods from this dataset. If an infrastructure/capital good is produced with the intention to be used one or a few times only (e.g., a manufacturing plant or machinery constructed to produce only one product), this infrastructure/capital good shall be included.

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

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

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

4.3.3 OTHER BOUNDARY SETTING

4.3.3.1. Boundary towards nature

Boundaries to nature are defined as where the flows of material and energy resources leave nature and enter the technical system (i.e. the product system). Emissions cross the system boundary to nature when they are emitted to air, soil or water.

4.3.3.2. Boundary towards other technical systems

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

See Section 4.6 for further guidance.

4.3.3.3. Temporal boundary

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

4.3.3.4. Geographical boundary

The geographical boundary defines the geographical coverage of the LCA. This shall reflect the physical reality of the product under study, accounting for the representativeness of technology, input materials and input energy.

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

4.4 SYSTEM DIAGRAM

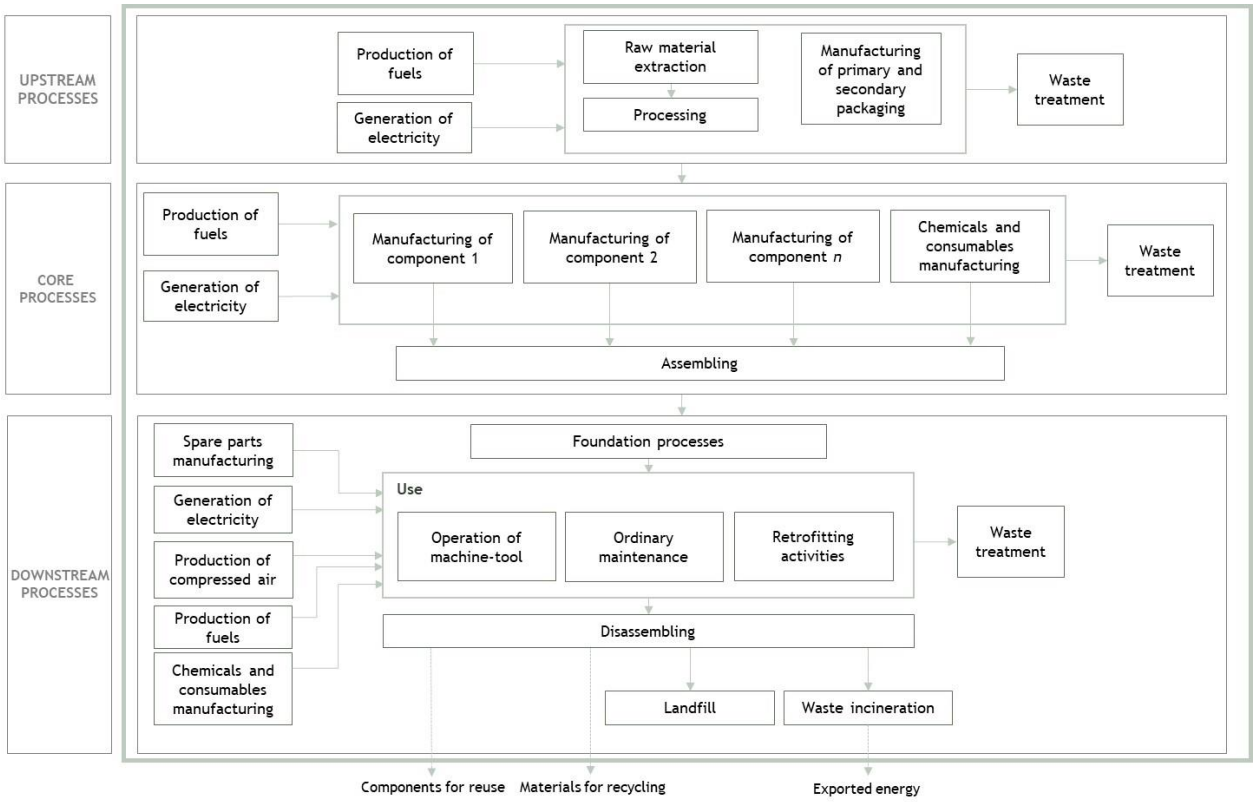

Figure 2 System diagram illustrating the processes that shall be included in the product system, divided into upstream, core and downstream processes. The illustration of processes to include may not be exhaustive.

4.5 CUT-OFF RULES

A cut-off rule of 1% shall be applied. In other words, the included inventory data (not including inventory data of processes that are explicitly outside the system boundary as described in Section 4.3) shall together give rise to at least 99% of the results of any of the environmental impact categories. Also, 99% of the mass of the product content and 99% of the energy use of the product life cycle shall be accounted for. The cut-off of inventory data should, however, be avoided, and all available inventory data shall be used.

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

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

- Any missing material production shall be represented by “Cast iron {GLO}”
- Any missing transport in the upstream processes shall be represented by “500 km of road transport with lorry”

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

The check for cut-off rules in a satisfactory way is through a sensitivity analysis in which it is possible to understand how the un-investigated input or output could affect the final results.

4.6 ALLOCATION RULES

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

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

4.6.1 CO-PRODUCT ALLOCATION

The following hierarchy of allocation methods shall be followed for co-product allocation:

1. Allocation shall be avoided, if possible, by dividing the process to be allocated into sub-processes and collecting the inventory data for each sub-process.
2. If allocation cannot be avoided, the inventory data should be partitioned between the different co-products in a way that reflects the underlying physical relationships between them, i.e. allocation should reflect the way in which the inventory data changes if the quantities of delivered co-products change.
3. If a physical relationship between the inventory data and the delivery of co-products cannot be established, the inventory data should be allocated between the co-products in a way that reflects other relationships between them. For example, inventory data might be allocated between co-products in proportion to their economic values. If economic allocation is used, a sensitivity analysis exploring the influence of the choice of the economic value shall be included in the LCA report.

For key processes in the product system, Table 4 provides specific allocation guidance.

Table 4 Allocation method for key processes in the product system.

PROCESS	MAIN PRODUCT AND CO-PRODUCTS	ALLOCATION METHOD
Machining	Main parts and components of other equipments	Time of machining (h)
Painting	Main parts and components of other equipments	Painted area (m^2)

4.6.2 ALLOCATION OF WASTE TREATMENT PROCESSES

Allocation of waste shall follow the polluter pays principle and its interpretation in EN 15804: “processes of waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached.” The end-of-waste state is reached when all the following criteria for the end-of-waste state are fulfilled (adapted from EN 15804):

- the recovered material, component or product is commonly used for specific purposes;
- a market or demand, identified e.g. by a positive economic value, exists for such a recovered material, component or product;
- the recovered material, component or product fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- the use of the recovered material, product or construction element will not lead to overall adverse environmental or human health impacts.

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

4.7 DATA QUALITY REQUIREMENTS AND SELECTION OF DATA

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

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

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

Energy consumption (kWh) by operational mode in the use stage, shall be represented by specific data.

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

4.7.1 RULES FOR USING GENERIC DATA

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

- datasets shall be based on attributional LCA modelling (e.g., not be based on marginal data and not include credits from system expansion),
- the reference year shall be as current as possible and should be representative for the validity period of the EPD,
- the 1% cut-off rule (as described in Section A.3.3) shall be met on the level of the product system,
- datasets shall represent average values for a specific reference year; however, how data are generated could vary, e.g. over time, and then they should have the form of a representative annual average value for a specified reference period (such deviations shall be justified and declared in the EPD), and
- the representativeness of the data shall be assessed to be better than ±5%, in terms of the environmental impact calculated on the basis of the data, of data that is fully representative for the given temporal, technological and geographical context.

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

It is recommended to include in the LCA study a data quality table to compare the quality of the data used in the study versus the data quality requirements listed in this PCR. Deviations shall be registered.

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

The EPD shall identify the unit processes represented by generic and specific data not meeting precision, completeness, representativeness criteria given in this PCR.

4.7.2 DATA QUALITY REQUIREMENTS AND OTHER MODELLING GUIDANCE PER LIFE-CYCLE STAGE

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

4.7.2.1. Upstream processes

- Data referring to processes and activities upstream in a supply chain over which the EPD owner direct management control shall be specific and collected on site.
- Data referring to contractors that supply main parts, packaging, or main auxiliaries should be requested from the contractor as specific data, as well as infrastructure, where relevant.
- Data on transport of main parts and components along the supply chain to a distribution point (e.g. a stockroom or warehouse) where the final delivery to the manufacturer can take place, should be specific and based on the actual transportation mode, distance from the supplier, and vehicle load.
- In case specific data is lacking, selected generic data may be used. If this is also lacking, proxy data may be used (see Section 4.7).
- For upstream processes modelled with specific data, generation of electricity used shall be accounted for in this priority:

    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market[5].
    4. Electricity consumption mix on the market[6].

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

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

    The mix of electricity used in upstream processes shall be documented in the EPD, where relevant.
- Packaging: specific data shall be used for production of consumer packaging production if the production is under the direct control of the EPD owner or if the environmental impact related to the consumer packaging of the production is more than 10% of the declared results in any of the environmental performances indicators. In other cases, generic data may be used. When consumer packaging shows the organization's logo, the LCA report should report the exerted/non-exerted direct control on the production of consumer packaging by the organization.

4.7.2.2. Core processes

- Transport from the final delivery point of raw materials, chemicals, main parts, and components (see above regarding upstream processes) to the manufacturing plant/place of service provision should be based on the actual transportation mode, distance from the supplier, and vehicle load, if available.
- Goods: Specific data shall be used for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant.
- Services: Specific data shall be used for the consumption of materials, chemicals, steam, heat, electricity, etc., necessary for execution of the service
- For electricity used in the core processes, generation of electricity used shall be accounted for in this priority:

    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.

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

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

3. Residual electricity mix on the market[7].
4. Electricity consumption mix on the market[8]. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control, as long as the composition of the residual grid mix has been publicly disclosed[9].

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

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

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

- Waste treatment processes of manufacturing waste should be based on specific data, if available.

4.7.2.3. Downstream processes

- Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant.
- Experimental data for electricity consumption in the use stage should be based on a functional mapping or manufacturing route, which shall be defined and declared in the EPD. As well as, relevant parameters such as the operating states, their duration in time, the accuracy of machine parts and the productivity of the machine tool shall be declared. When comparing machine tools, these parameters shall be defined clearly.
- Information on the average power factor, active power (W), as well as electrical current (mA) of experimental data, shall be reported in the LCA report as well as environmental conditions during the test procedure. The method used to determine the energy consumption in the use stage, as well as the apparatus and instruments used for this purpose shall be referenced in the LCA report. The energy consumption shall be measured at the entrance of the machine,
- This PCR includes a default total time diagram (see Figure 3) and an operating states selection that shall be used when the properties of the workpiece (material, shape, accuracy, surface quality), the constraints of production (minimum lot size, flexibility), types of user behaviour or different manufacturing strategies during the use stage are unknown.
- The total time diagram shows distributions of time spent in the respective states to determine the total use. Each operating state defines if mains, peripheral units, machine tool control, machine tool processing unit, and machine motion units are "mode ON", mode OFF, or mode HOLD. Table 5 shows the definitions of the terms used in the total time diagram.

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

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

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

Figure 3 Total time diagram.

Table 5 Definition of terms used in the total time diagram in Figure 3.

Time	Definition
Lifetime	The theoretical total net production time of a milling machine during its life if the suggested maintenance is performed.
Total time	The continuous time interval during which the performance of the equipment is considered.
Not worked time	The time interval during which the equipment is not used.
Available time	Time scheduled for production, from the start of shift to the end of shift.
Planned stop time	The accumulated time interval during which a Planned Stop occurs. It is the sum of the time dedicated to preparation phase, after production phase and planned maintenance.
Available production time	The time during which the equipment could have been performing a required function if an unplanned stop has not occurred.
Idle time	The accumulated time interval from when the equipment becomes idle until the equipment is back in the same state as it was before the stop occurred.
Possible production time	Time period during which the equipment could have been performing a required function without stops.
Machining time	The time during which the equipment reaches its primary required function, material removing, axis movement without any contact with the pieces.
Material removing time	The time during which the equipment is applying cutting effort.
Grinding time	The time during which machining is carried out on the previously machined bloom to obtain the final finish. The bloom is flattened to obtain level surfaces with the tolerance desired (milling head 75%).
Drilling time	The time interval during which holes are bored in bloom by cutting edges (diameter 20/depth 60).
Several time	The time during which is carried out semi-finishing and finishing operations (Milling Head is working at 15%).

An example of operating states[10] for a material-cutting machine tool are outlined below.

Machine OFF: Mains OFF

- STAND BY: Mains ON, machine control OF, peripheral units ON, machine processing unit OFF, motion unit OFF

Note: STAND BY describes the situation where there is a residual consumption of energy by machine parts, i.e. detectors, pumps… the unit is not operating, but with tension.

- READY FOR OPERATION: Mains ON, machine control ON, peripheral units ON, machine processing unit ON HOLD, machine motion unit ON HOLD

Note: ON HOLD describes the situation where the unit is ON but not operating, i.e. no processing takes place, no movements are carried out. For example, engines and control are ON and if necessary, they would control and correct the position (normally, it is not necessary to correct the position because there is no movement, so the energy consumption is negligible).

- WARM UP: Mains ON, machine control ON, peripheral units ON, machines processing unit ON but no machining takes place (MILLING HEAD ON HOLD), machine motion ON and axes MOVING (2 mm/min).
- EXTENDED WARN UP: Mains ON, machine control ON, peripheral units ON, machines processing unit ON but no machining takes place (MILLING HEAD ON HOLD), machine motion ON and axes MOVING (2000 mm/min)
- PROCESSING 1: Mains ON, machine control ON, peripheral units ON, machine processing unit ON and machining (GRINDING OPERATION), machine motion unit ON and axes MOVING, cutting oil injector OFF, chip removal OFF, lights OFF.

Note: GRINDING OPERATION describes the operation on the previously machined bloom to obtain the final finish. The machining bloom is flattened to obtain level surfaces with the tolerance desired, milling head works at 75%.

- PROCESSING 2: Mains ON, machine control ON, peripheral units ON, machine processing unit ON and machining (SEMIFINISHING OPERATIONS), machine motion unit ON and axes MOVING, cutting oil injector OFF, chip removal OFF, lights OFF.

Note: SEMIFINISH OPERATIONS describes the operations which improve the surface quality, milling head works at 15%.

- PROCESSING 3: Mains ON, machine control ON, peripheral units ON, machine processing unit ON and machining (DRILLING OPERATION), machine motion unit ON and axes MOVING, cutting oil injector OFF, chip removal OFF, lights OFF

Note: DRILLING OPERATION makes hollow diameter 20/depth 60.

Furthermore, additional measurements shall be carried out, taking into account the energy demand from the auxiliary elements (accessories) included in the reconfiguration, if applicable, e.g:

- Energy consumption associated with the chip conveyor
- Energy consumption associated with the cutting oil fluid injector
- Energy consumption associated with work light
- Energy consumption associated with tool changes
- Energy consumption associated with milling head spins

- The use of electricity in the region/country where the product is used (as specified in the geographical scope of the EPD) shall be modelled with::
  - Electricity consumption mix on the market[11]. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control, as long as the composition of the residual grid mix has been publicly disclosed[12].

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

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

  The mix of electricity used in the downstream processes shall be documented in the EPD, where relevant.

- The transport of the product to the customer shall be described in the EPD, where relevant, and be accounted for in this priority:

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

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

1. Actual transportation modes and distances to specific a customer or market, representing the geographical scope of the EPD.
2. A weighted average of transportation modes and distances, based on transportation to several customers or markets, representing the geographical scope of the EPD.

- Calculated as a fixed long transport, as 1 000 km transport by lorry to the retailer or 10 000 km by ship from the production plant to the main destination country plus 500 km from the port to the distribution center by lorry. Scenarios for the end-of-life stage shall be technically and economically practicable and compliant with current regulations in the relevant geographical region based on the geographical scope of the EPD. Key assumptions regarding the end-of-life stage scenario shall be documented in the LCA report.
- Scenarios for the end-of-life stage shall be technically and economically practicable and compliant with current regulations in the relevant geographical region based on the geographical scope of the EPD. Key assumptions regarding the end-of-life stage scenario shall be documented in the EPD.
- Machine tools are equipment with a very long lifetime and their elements have a very high sale's potential in the second-hand market. For this reason, it is difficult to define a waste management scenario. A normal practice, due to the high cost that supposes the investment in new capital goods, is the replacement or substitution of the parts of machinery which become obsolete, giving rise to a new reconstruction of the machine in order to be used afterwards: retrofitting, thus extending the lifespan of the product. If necessary to fulfil the functional unit (see 4.1), refurbishment shall be included in the LCA. For example, refurbishment can include the transportation and waste management of the replaced part, and the production and transportation of the new part with the same or improved features. If a retrofitting activity takes place for one or more of the main parts of the product so that the technical lifespan of the product is expected to exceed the 15 years of the RSL, the environmental burdens of the original product manufacturing plus the retrofitting should be attributed to the RSL (and hence the functional unit) proportionally based on the total technical lifespan achieved. To provide guidelines on how to deal with retrofitting the following informative examples are provided:

  Case A: No retrofitting, lifetime of 15 years: the product enters the end-of-life stage after 15 years and all burdens associated with the original manufacture are assigned 100% to the RSL

  Case B: No retrofiting, lifetime of 20 years: 15/20 of the burdens associated with the original manufacture are assigned to the RSL.

  Case C: Retrofitting occurring before the end of the RSL (e.g. at year 10), thus extending the technical lifespan of the product up to 20 years: the burdens of original manufacture and the retrofitting are added together, then 15/20 of the total burdens are assigned to RSL.

  Case D: Retrofitting occurring at the end of the RSL (i.e. after year 15), thus extending the technical life of the product up to 20 years: the burdens of original manufacture and revamping are added together, then 15/20 of the total burdens are assigned to the RSL.
- Due to the B2B (business to business) characteristics of this product, it can be assumed, that the end-of-life largely happens under well-controlled and state-of-the-art conditions. Also, most of the components represent a remarkable intrinsic value due to the scrap metal values, so high downstream recycling quotas can be anticipated.
- Recommendations for source separation and recycling can be given in the EPD, as well as recommendations for other waste treatment of product parts if relevant. Such recommendation shall be given as additional environmental information, see Section 5,4.6
- Recycling quotas and waste treatment methods are stated by Schischke et al. (2012a). These may be used as end-of-life scenarios for milling machines:
  - The outstanding part of metal materials (95% of the final product weight) is subject to recycling.
  - 0.2% of the final product is sent to landfill.
  - 80% of plastics and printed wiring board (PWB) are sent to incineration.
  - 19% of plastics are sent to recycling.
  - 1% of plastics are re-used.
- End-of-life processes of distribution packing: The management of packaging waste varies a lot from country to country and equipment user to user. Due to the high variability of waste treatment options and practices at packing end-of-life, waste

management scenarios for packaging, e.g. packing cases, boxes, crates, drums and similar packaging, of wood and the required tools for transportation e.g., textile slings, steel wire rope slings, shall be based on the nature of material.

- General scenarios may be used as end of life setting for packaging:
- 80% of plastics are sent to incineration.
- 19% of plastics are sent to recycling.
- 1% of plastics are re-used.
- 99% of wood is sent to incineration.
- 1% of wood is re-used.
- 100% of metal is sent to recycling (lifting devices or securing of load).

4.7.3 DATA QUALITY DECLARATION

EPDs may include a declaration of the quality of data used in the LCA calculations.

It is recommended to include in the LCA report a data quality table to compare the quality of the data used in the study versus the data quality requirements listed in this PCR. Deviations shall be registered. The EDP may include a data quality declaration to demonstrate the share of specific data, selected generic data and proxy data for the environmental impacts.

4.8 ENVIRONMENTAL PERFORMANCE INDICATORS

The EPD shall declare the default environmental performance indicators and their methods as described at the website (www.environdec.com/indicators), which includes both inventory indicators and indicators of potential environmental impact. The source and version of the impact assessment methods and characterisation factors used shall be reported in the EPD. Also other indicators may be declared, if justified, see Section 5.4.5.

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

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

4.9 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

4.9.1 PRODUCTS FROM THE SAME COMPANY

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

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

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

The option chosen shall be clearly described in the EPD.

In the case that the product is specified with a modular scope, the results of potential environmental impact must be expressed as a specific reconfiguration, depending on the representative product:

- the basic configuration (RECONF),
- the basic configuration plus accessory 1, (RECONF + ACS1)
- the basic configuration plus accessory 2, (RECONF + ACS2)
- the basic configuration plus accessory n, (RECONF + ACSn)
- the maximum configuration, (RECONF+ACS1 +….+ ACSn)

The EPD shall declare which is the representative configuration.

4.9.2 SECTOR EPDS

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

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

The following information shall also be included a Sector EPD:

- a list of the contributing manufacturers that the Sector EPD covers,
- a description of how the selection of the sites/products has been done and how the average has been determined, and
- a statement that the document covers average values for an entire or partial product category (specifying the percentage of representativeness) and, hence, the declared product is an average that is not available for purchase on the market.

5 CONTENT AND FORMAT OF EPD

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

The EPD content shall:

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

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

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

5.1 EPD LANGUAGES

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

5.2 UNITS AND QUANTITIES

The following requirements apply for units and quantities:

- The International System of Units (SI units) shall be used where available, e.g., kilograms (kg), Joules (J) and metres (m). Reasonable multiples of SI units may be decided in the PCR to improve readability, e.g., grams (g) or megajoules (MJ). The following exceptions apply:
  - Resources used for energy input (primary energy) should be expressed as kilowatt-hours (kWh) or megajoules (MJ), including renewable energy sources, e.g., hydropower, wind power and geothermal power.
  - Water use should be expressed in cubic metres (m^3)
  - Temperature should be expressed in degrees Celsius (°C),
  - Time should be expressed in the units most practical, e.g., seconds, minutes, hours, days or years.
  - Results of the environmental performance indicators shall be expressed in the units prescribed by the impact assessment methods, e.g. kg CO_2 equivalents.
- Three significant figures[14] should be adopted for all results. The number of significant digits shall be appropriate and consistent.
- Scientific notation may be used, e.g. 1.2E+2 for 120, or 1.2E-2 for 0.012.
- The thousand separator and decimal mark in the EPD shall follow one of the following styles (a number with six significant figures shown for illustration):
  - SI style (French version): 1 234,56
  - SI style (English version): 1 234.56

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

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

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

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

5.3 USE OF IMAGES IN EPD

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

5.4 EPD REPORTING FORMAT

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

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

The following sections may be included:

- Additional environmental information (see Section 5.4.6)
- Additional social and economic information (see Section 5.4.7)

The following sections shall be included, if relevant:

- Differences versus previous versions (see Section 5.4.8)
- Executive summary in English (see Section 5.4.10)

5.4.1 COVER PAGE

The cover page shall include:

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

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

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

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

In the case of EPDs registered through a regional hub (a regional or national programme based on and fully aligned with the International EPD System through an agreement with the programme operator), "Programme", "Programme operator", and "Logotype" shall be expanded to include a reference to the regional programme and the organisation responsible for it.

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

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

5.4.2 PROGRAMME INFORMATION

The programme information section of the EPD shall include:

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

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

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

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by individual verifier Third-party verifier: *<name, organisation, and signature of the third-party verifier>* Approved by: The International EPD System
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by accredited certification body Third-party verification: *<name, organisation>* is an approved certification body accountable for the third-party verification The certification body is accredited by: *<name of accreditation body & accreditation number, where applicable>*
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006 via: ☐ EPD verification by EPD Process Certification* Internal auditor: *<name, organisation>* Third-party verification: *<name, organisation>* is an approved certification body accountable for third-party verification Third-party verifier is accredited by: *<name of accreditation body & accreditation number, where applicable>* *For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see GPI v4, Section 7.5.
Procedure for follow-up of data during EPD validity involves third-party verifier[18]: ☐ Yes ☐ No

5.4.3 PRODUCT INFORMATION

The product information section of the EPD shall include:

- address and contact information to EPD owner,
- description of the organisation. This may include information on products- or management system-related certifications (e.g. ISO 14024 Type I environmental labels, ISO 9001- and 14001-certificates and EMAS-registrations) and other relevant work the organisation wants to communicate (e.g. SA 8000, supply-chain management and social responsibility),
- name and location of production site,

[18] Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period (see Sections 7.3.2 and 7.4.9 of the GPI). The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update (see Section 6.5 of the GPI) is identified, the EPD shall be re-verified by a verifier.

- product identification by name, and an unambiguous identification of the product by standards, concessions or other means,
- identification of the product according to the UN CPC scheme system (if a UN CPC code is available). Other relevant codes for product classification may also be included, e.g.
  - Common Procurement Vocabulary (CPV),
  - United Nations Standard Products and Services Code® (UNSPSC),
  - Classification of Products by Activity (NACE/CPA),
  - Australian and New Zealand Standard Industrial Classification (ANZSIC), or
  - Global Trade Item Number (GTIN).
- a description of the product,
- a description of the technical purpose of the product, including its application/intended use,
- a description of the background system, including the main technological aspects,
- for EPDs covering multiple products: a description of the selection of products/sites, a list of contributing manufacturers (if Sector EPD), etc. (see Section 4.9),
- geographical scope of the EPD, i.e., for which geographical location(s) of use and end-of-life the product's performance has been calculated,
- declared/functional unit,
- reference service life (RSL) and/or technical/actual lifespan, if relevant,
- declaration of the year(s) covered by the data used for the LCA calculation and other relevant reference years,
- reference to the main database(s) for generic data and LCA software used, if relevant,
- system diagram of the processes included in the LCA, divided into the life cycle stages,
- description if the EPD system boundary is "cradle-to-gate", "cradle-to-gate with options" or "cradle-to-grave",
- information on which life-cycle stages are not considered (if any), with a justification of the omission, and
- references to any relevant websites for more information or explanatory materials.

This section may also include:

- name and contact information of organisation carrying out the underlying LCA study,
- any additional information about the underlying LCA-based information, such as cut-off rules, data quality, allocation methods, and other methodological choices and assumptions,
- a description of the material properties of the product with a declaration of relevant physical or chemical product properties, such as density, etc., and
- if end-of-life treatment is not included, the EPD shall contain a statement that it shall not be used for communicating environmental information to consumers/end users of the product.

5.4.4 CONTENT DECLARATION

The content declaration section shall declare the weight of one unit of product, as purchased, and contain information about the content of the product in the form of a list of materials and chemical substances including information on their environmental and hazardous properties. The gross weight of each material/substance shall be declared, including a minimum of 99% of the materials/substances in one unit of product.

The content declaration does not apply to proprietary materials and substances covered by exclusive legal rights including patent and trademarks. In general, an indication that a product is "free" of a specific hazardous material or substance should be done with caution and only when relevant, following the rules in ISO 14021 on self-declared environmental claims.

Information on the hazardous properties of materials and chemical substances should follow the requirements given in the latest revision of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS),[19] issued by the United Nations or national or regional applications of the GHS. As an example, the following regulations should be used for EPDs intended to be used in the European Union:

- Regulation (EC) No 1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH); and
- Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling, and packaging of substances and mixtures.

It is necessary to identify specific chemical preparations applied in the process, and the concentrations of substances present in these preparations according to their material safety data sheets. Whenever necessary, due to lack of specific database, a substance can be represented by a similar one (in molecular or functional structure). The considered substances and their respective concentrations (the upper limit of concentration interval) then must be included in the LCA study. Table 6 provides a template to collect the recommended information of chemical preparations applied in the process.

PREPARATION USE IN THE PROCESS	HAZARD IDENTIFICATION OF THE PREPARATION LISTED ON MSDS	SUBSTANCES AND RISK PHRASES LISTED ON MSDS	SUBSTANCES AND RISK PHRASES OF THE CONSIDERED SUBSTANCES USED IN THE LCA

Table 6: Identification and replacement of chemical substance by approximation

5.4.4.1. Information about recycled materials

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

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

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

5.4.4.2. Information about packaging

As packaging is strongly connected with the product, the producer shall provide information about packaging in the EPD, when applicable. Packaging may be classified as:

- Distribution Packaging: packaging designed to contain one or more articles or packages, or bulk materials, for the purposes of transport, handling and/or distribution (ISO 21067-1:2016, Section 2.2.6)
- Consumer Packaging: packaging constituting, with its content, a sales unit for the final user or consumer at the point of retail (ISO 21067-1:2016, Section 2.2.7).

Consumer packaging is generally the outcome of eco-design processes, or other activities, under direct control of the organisation. Many critical categories with strict legal requirements belong to consumer packaging category like food contact packaging and pharmaceutical packaging.

The weight of the packaging per product, and the type and function of the packaging, shall be reported in the EPD.

A statement of the source of the materials (pre-consumer or post-consumer) shall be presented in the EPD when the packaging is made in whole or in part by recycled materials.

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

5.4.5 ENVIRONMENTAL PERFORMANCE

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

5.4.5.1. Environmental impacts

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

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

5.4.5.2. Use of resources

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

5.4.5.3. Waste production and output flows

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

5.4.6 ADDITIONAL ENVIRONMENTAL INFORMATION

An EPD may declare additional environmentally relevant information not derived from the LCA-based calculations, such as:

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

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

5.4.7 ADDITIONAL SOCIAL AND ECONOMIC INFORMATION

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

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

5.4.8 DIFFERENCES VERSUS PREVIOUS VERSIONS

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

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

5.4.9 REFERENCES

A reference section shall be included, including a list of all sources referred to in the EPD, including the GPI (including version number), and PCR (registration number, name, and version) used to develop the EPD.

5.4.10 EXECUTIVE SUMMARY IN ENGLISH

The executive summary, if included (see Section 5.1), shall contain relevant summarised information related to the programme, product, environmental performance, information related to pre-certified EPDs, and information related to sector EPDs. Besides this, further information may be added such as additional environmental, social or economic information, references as well as differences versus previous EPD versions.

6 LIST OF ABBREVIATIONS

ACS	Optional accessories of the machine
ANZSIC	Australian and New Zealand Standard Industrial Classification
CPC	Central product classification
CPV	Common procurement vocabulary
EPD	Environmental product declaration
GPI	General Programme Instructions
GTIN	Global trade item number
ISO	International Organization for Standardization
LCA	Life cycle assessment
LCI	Life cycle inventory
MOD	Structural/functional modules of the machine
NACE/CPA	Classification of products by activity
ND	Not declared
PCR	Product category rules
REACH	Restriction of chemicals
RECONF	Standard configuration of the machine
RSL	Reference service life
SI	The International System of Units
UN	United Nations
UNSPSC	United Nations standard products and services code

7 REFERENCES

CEN (2013) EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

CEN (2019) EN 15804:2012+A2:2019, Sustainability of construction works – Environmental product declarations – Core rules for theproduct category of construction products.

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

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

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

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

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

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

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

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

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

ISO (2016a) ISO 21067-1:2016, Packaging – Vocabulary – Part 1: General terms.

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

ISO (2017) ISO 21930:2017, Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.

ISO (2018) ISO 14024:2018, Environmental labels and declaration – Type I environmental labelling – Principles and procedures.

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

Martínez Herrero, E., Pereda Pereda, L., Huidobro Fernández, F. *et al.* An environmental evaluation of a milling machine range: a case study on reconfigurable approach. *SN Appl. Sci.* **1,** 1513 (2019). https://doi.org/10.1007/s42452-019-1552-7

Koren Y., et al. (1999) Reconfigurable machine tool: CNC machine for milling, grinding and polishing. Procedia Menufacturing 21 (2018) 221-227

Schischke K, Hohwieler E, Feitscher R, König J, Kreuschner S, Wilpert P, Nissen N. (2012a) Energy-Using Product Group Analysis-Lot 5 Machine tools and related machinery Task 4 Assessment of Base Case. Fraunhofer Institute for Reliability and Microintegration, IZM, Department Environmental and Reliability Engineering, Berlin.

Schischke K, Hohwieler E, Feitscher R, König J, Kreuschner S, Wilpert P, Nissen NF (2012b) Energy-Using Product Group Analysis-Lot 5 Machine tools and related machinery Task 1 Report-Definition. Fraunhofer Institute for Reliability and Microintegration, IZM, Department Environmental and Reliability Engineering, Berlin.

Updating of the life cycle assessment study (LCA) of the compact fixed bed milling machine range, NORMA. Martínez E (2017)

ISO 14955-1 Machine tools-Environmental evaluation of machine tools part 1: Design methology for energy-efficient machine tools

8 VERSION HISTORY OF PCR

VERSION 1.0, 2012-01-25

Version 1.0 of the PCR was published.

VERSION 1.01, 2013-07-17

Minor editorial changes and use of the PCR template.

VERSION 2.0, 2014-07-11

- Updated to comply with the latest General Programme Instructions (version 2.01)
  - General introduction and general information updated.
  - References added in the document and updated.
  - The explicit exclusion of business travel of personnel from the product life cycle.
  - Update of Electricity mix used in the process.
  - Updated indicators for resource use, waste production and potential environmental impact.
  - Update section on EPD validity.
  - Clarification on use phase scenario.
  - Emissions of ozone-depleting gases no longer mandatory.
- Minor editorial changes and clarifications, e.g. the inclusion of primary and secondary packaging was added.
- “A maximum of three decimal units” was changed to “A maximum of three significant digits”.
- Clarification that specific data shall be used in the core module.
- Methods used to assess noise, vibration and electromagnetic wave emissions shall be declared in the EPD.
- More examples of machines-tool and manufacturing processes were included in Specification of the Product.
- Clarification that parameters shall be included in Declared Unit.
- Information modules were included in the flowchart.
- Examples of quantification of diffusion emissions were included in Allocation Rules.
- A template to collect the information of chemical preparations was included in Data Quality Rules.
- A recycling declaration and end of life scenarios were included.
- Validity updated.
- References added.

VERSION 3.0, 2018-10-22

- Updated to comply with the latest General Programme Instructions (version 3.0).
  - Duration of validity of the EPD.
  - Criteria for the inclusion of several products in an EPD.
  - Units for the indicator for recourses.
- Use of the lasts PCR template and adaptation to PCR Product of agriculture horticulture ad market gardening product category classification: UN CPC 01.).

- New product definition in line with the standard ISO 14955-1: 2017 .
- Specification of further technical information in the product description.
- Elimination of other environmental indicators.
- Some upstream processes were not listed, now they are included.
- Natural gas is included in System Diagram.
- Identification of material flows in the use phase.

VERSION 3.01, 2018-10-23

- Editorial update to correct broken links

VERSION 3.02, 2019-09-06

- Clarified terms of use.
- Editorial changes.

VERSION 4.0.0, 2024-02-27

- Changed name and scope of PCR.
- Other programmes have been checked to avoid overlaps in the scope: ADEME, NESF, EPD Norge and Global EPD.
- Table 3 is included where one PCR was considered to avoid overlap in the scope.
- New scientific article are included as underlying studies used for the PCR development.
- Change from declared unit to functional unit.
- The unit process *"Recycling process of secondary materials from other product life cycle"* is classified as an upstream process.
- A sensitivity analysis is defined to check the cut-off rules.
- A guide on how to deal with retrofitting are provided
- Default distances are defined to transport.
- New Section 4.3.2 on the modelling of infrastructure and capital goods.
- Changed system diagram in Section 4.4.
- Updated to comply with the latest General Programme Instructions (version 4.0), e.g. with regards to:
    - 4.3.3 Other Boundary Setting
    - 4.5 Cut-off rules
    - 4.6 Allocation rules
    - 4.7 Data quality requirements and selection of data, clarified rules on electricity modelling
    - 4.8 Environmental performance indicators.
    - 4.9 Including multiple products in the same EPD.
    - 5.4 EPD reporting format

MACHINE-TOOLS FOR DRILLING, BORING OR MILLING METALS AND COMPOSITE MATERIALS
PRODUCT CATEGORY CLASSIFICATION: UN 44214