PRODUCT CATEGORY RULES (PCR)
DATE 2022-06-01

MACHINE-TOOLS FOR MATERIAL WORKING BY REMOVAL OF MATERIAL BY LASER OR SIMILAR

PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211

PCR 2021:10
VERSION 1.0.3

VALID UNTIL 2025-12-21

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 http://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.

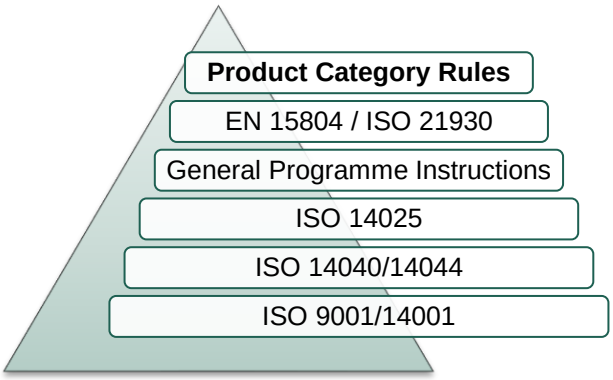

Figure 1 The hierarchy between PCRs, standards and other documents. EN 15804 and ISO 21930 are normative standards for construction products only.

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 at http://www.environdec.com. Stakeholder feedback on PCRs is very much encouraged. Any comments on this PCR may be sent directly to the PCR Moderator and/or the Secretariat during its development or during its period of validity.

Any references to this document 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 material working by removal of material by laser or similar
Registration number and version:	2021:10
Programme:	The International EPD® System
Programme operator:	EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. Website: www.environdec.com E-mail: info@environdec.com
PCR Moderator:	Carlo Brondi, CNR-STIIMA, Italy - carlo.brondi@stiima.cnr.it
PCR Committee:	CNR-STIIMA - The Institute of Intelligent Industrial Technologies and Systems for Advanced Manufacturing - National Research Council of Italy TENOVA - Innovative solutions for metals & mining
Date of publication and last revision:	2022-06-01 (Version 1.0.3) See section 8 for a version history.
Valid until:	2025-12-21
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 how to proceed with updating the PCR and renewing its validity. A PCR may be 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 working any material by laser or similar process and the declaration of this performance by an EPD. The product category corresponds to UN CPC Machine-tools for working any material by removal of material, by laser or other light or photon beam, ultra-sonic, electro-discharge, electro-chemical, electron beam, ionic beam or plasma arc processes, water-jet cutting machines.

This category includes any machinery and machine-tools for working any material by removal of material, by laser or other light or photon beam, ultra-sonic, electro-discharge, electro-chemical, electron beam, ionic beam or plasma arc processes, and water-jet cutting machines.

The hierarchical structure is:

 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 44211 - Machine-tools for working any material by removal of material, by laser or other light or photon beam, ultra-sonic, electro-discharge, electro-chemical, electron beam, ionic beam or plasma arc processes, water-jet cutting machines

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

This PCR excludes:

- Agricultural or forestry machinery
- Machinery for metallurgy
- Machine-tools for drilling, boring or milling metal, which is covered by PCR 2012:02
- Machinery for mining, quarrying and construction
- Machinery for food, beverage and tobacco processing
- Machinery for textile, apparel and leather production, whereof a subset is covered by PCR 2010:18 Other special- and general-purpose machinery and parts thereof
- Machine tools for working stone, ceramics, concrete, asbestos, cement or like mineral materials or for cold working glass, which is covered by PCR 2010:18 Other special- and general-purpose machinery and parts thereof
- Weapons and ammunition
- Domestic appliances
- Other special-purpose machinery and parts thereof, which is covered by PCR 2010:18 Other special- and general-purpose machinery and parts thereof
- Other general-purpose machinery and parts thereof, which is covered by PCR 2010:18 Other special- and general-purpose machinery and parts thereof

Examples of included special-purpose machinery are:

- Machine for laser incision and texturing
- Water-jet machine tools
- Electrochemical discharge machine-tools for surface finishing
- Laser machines for cuttings

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

The specification of the product should 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'). Since machines can be highly customized to different purposes, the EPD shall include specifications of all physical modules, accessories and reconfigurations under declaration.

The contribution to the impact categories that the auxiliary elements generate in adding to those caused by standard configurations, should be reported separately.

The trade name (if relevant), species and the variety (if relevant) of product shall be declared. The production system should be specified, if relevant.

The EPD shall specify the technical performance and other information on the product as reported in Table 1 and Table 2. The information is mandatory any time they are applicable. If similar machines are included in the same EPD, see section 4.8, this information shall be specific to each machine independently.

Table 1: Machines description

INDICATORS	**EXAMPLES/EXPLANATIONS/COMPONENTS**
Commercial name	*As stated in the operating manual and sales catalogues*
Head	*.....*
Size and dimension	*Length (X Axis), width (Y Axis), height (Z Axis) (mm)*
Weight	*kg*
Maximum load on the table	*kg*
Surface table	*mm x 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)	*Voltage, 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*

[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.

Table 2: Technical information

INDICATORS	**EXAMPLES**
Functional performance (energy consumption) under different advances and different configurations	*kWh/m³*
Productivity,	*kWh/h*
Processing module power	*kW*
Total power	*kW*
Processing material consumption	*NM/h*
Lubricating oil consumption	*kg/h*
Refrigerating fluid consumption	*kg/h*
Finishing technology	*laser, electro-erosion, other*

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:

- a variation 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.

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 2021-05-10 until 2021-07-10, 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 stakeholders provided comments during the open consultation and agreed to be listed as contributors in the PCR and at www.environdec.com.

- Tenova Pomini

3.2 PCR REVIEW

3.2.1 VERSION 1.0

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:	Lars-Gunnar Lindfors
Review dates:	2021-10-19 until 2021-11-30

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. https://industries.ul.com/environment/transparency/product-category-rules-pcrs
- JEMAI CFP Program. https://www.cfp-japan.jp/english/
- JEMAI EcoLeaf. http://www.ecoleaf-jemai.jp/eng/pcr.html
- KEITI Environmental Declaration of Product. http://www.epd.or.kr/eng/about/keitiInfo.do
- PEF System - https://ec.europa.eu/environment/eussd/smgp/ef_pilots.htm#pef

No existing PCRs with overlapping scope were identified.

Table 3 lists PCRs and other standardized methods considered in the development of this PCR.

Table 3: 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
Other special-purpose machinery and parts thereof	Version 3.01	2010:08	Machines designed for a special-purpose, as defined by the UN CPC group 449 and underlying classes.
Machine-tools for drilling, boring or milling metal	Version 3.02	2012:02	Assessment of the environmental performance of machine tools for drilling, boring or milling metal.

The guidance in the PCRs listed in Table 3 was considered in order to harmonize reporting on the machinery sector.

3.4 REASONING FOR DEVELOPMENT OF PCR

This PCR was developed to enable publication of EPDs for this product category based on ISO 14025 and 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 comparability of products within a product category.

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:

- 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. Dipl.-Ing. Karsten Schischke, Fraunhofer Institute for Reliability and Microintegration, IZM (2012) 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.

Using above studies as underlying studies were inspired by PCR 2012:02 Machine-tools for drilling, boring or milling metal, which also used these studies for its development.

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 DECLARED/FUNCTIONAL UNIT

Unit for study can be defined as follows

Functional unit can be used in case variation of actual use of machine can be tracked along its use phase. The Declared Unit can be used in case:

- the use phase cannot be tracked
- the physical transformation in worked items cannot be univocally defined by a set of indicators for defining improvements of the worked item performance,
- all functional and qualitative aspects are not possible to capture in the same unit.

These aspects should be taken into consideration when comparing EPDs based on this PCR.

Functional Unit can be defined as range of service that the machine can provide. The functional unit shall include the complete definition of set of provided physical performance for 1 physical unit of the processed material. Such aggregated profile shall be linked with

- A range of corresponding operational set up of machine and working conditions (machine set-up, auxiliary materials used, type of operation, processing time etc.)
- Contextual consumption and emissions for each working condition (that may be derived by a parametrization of consumptions and emissions according to the variation of working parameters)

Such information shall be linked with test campaigns. In addition to such information also sound assumptions on the actual use of the machine during its lifespan shall be defined. Such data should be referred to data from final users or, alternatively, to reasonable expected use of the machine. The functional unit aggregates such different information to provide a comprehensive range of service by a specific machine.

Alternatively, a **Declared Unit** can be defined as specific use condition of the working machine. The declared unit shall include the complete definition of a set of physical performance for 1 physical unit of the processed material to be linked with

- A precise operational set up of machine and a specific working conditions (e.g. machine set-up, auxiliary materials used, type of operation, processing time etc.)
- Contextual consumption and emissions for the selected working condition

Such information shall be linked with test campaigns by the company. The choice of the specific Declared Unit shall be extensively justified.

In addition to such information also sound assumptions on the effective use of the machine during its RSL shall be defined. Such data should be associated to a reasonable expected use of the machine in relation to a specific service performance, see Table 4 for operational reference.

Table 4: Operational parameters to be reported in the EPD

	Declared unit	Mandatory	Value	Standard Reference
Conditions of processed surface	Physical unit of processed material (linear, surface, volume, etc.)	Yes	1m/ $1m^2$/ $1m^3$/ 1kg	S.I.
	Material type	Yes		-
	Roughness (Ra)	No		BS EN 10049:2005
	Pick count for centimetre (Rpc)	No		BS EN 10049:2005
	Skew (Rsk)	No		ISO 4287:1997
	Waviness average amplitude(Wa)	No		ISO 4287:1997
	Average peak to valley height (Rz)	No		ISO 4287:1997
	Rootmean square deviation (Rq)	No		ISO 4287:1997
	Material Ratio (Rmr)	No		ISO 4287:1997
	Haze	No		ISO 13803
	DOI	No		ASTM D5767-A
	Gloss	No		ISO 2813
	Hardness	No		-
	Other	No		-

Operational conditions	Processing time for physical unit	Yes		S.I.
	Auxiliary materials	Yes		-
	Machine configurations	Yes		-
	Consumed power	No		-
	Geography (Continent)	Yes		-
	Reference Service Life (RSL)	Yes		-

In addition to Declared Unit a further description of machine performance can be provided by the user.

Such operation can be also contextualized with reference to a sequence of operations or to one type of working item (e.g. 1 worked metal item etc.) or alternatively one standard time, (e.g. 1 h of operation), during which operational conditions are still stated.

In order to calculate the impact for the whole machine tool, two aspects should be clarified:

- The expected lifetime production of machine tools (daily hours, annual operating days and total operating years)
- The productivity according to different operational modes.

This information is dependent on the production pattern. The use pattern of machine tool applied for calculating the usage scenario shall be included in the EPD

The declared unit shall be included in the EPD, as well as the references flow needed for comparing the upstream phase and the use phase. The declared unit shall be stated in the EPD. The environmental impact shall be given per declared unit. A description of the function of the product should be included in the EPD, if relevant.

The **Reference Service Life (RSL)** of a product category is the reference time to which the performance of all products of a product category shall be related. A range of use pattern is defined in this PCR, which have to be considered as base case in compatibility between claims, 20 h/day x 250 day/year x 30 years= 150 000 h expected lifetime.

4.2 SYSTEM BOUNDARY

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

4.2.1 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 4.2.1.1–4.2.1.3.

4.2.1.1. Upstream processes

All relevant unit processes along the upstream supply chain shall be included, for example:

- extraction and production of raw material for all main parts and components,
- recycling processes of secondary materials from other product life cycles,
- secondary processing of material for main parts and components,
- production of commercial products[4] used in the core process,
- transportation of raw material and commercial products,
- the manufacturing of primary and secondary packaging, if relevant, and

[4] Purchased elements are integrated in the machine and that are not transformed in the core processes.

- generation of electricity and production of fuels, steam and other energy carriers used in the 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 4.4.

4.2.1.2. Core processes

All relevant unit processes along the upstream supply chain shall be included, for example:

- external transportation to the core processes of the packaging of the final product to the factory,
- external transportation from the core processes (e.g. wastes to the landfills),
- manufacturing process for main parts and components according to a further specification below (see 4.8.2),
- internal transports within the manufacturing plant,
- assembly of the final machine tool,
- waste treatment of waste generated during manufacturing of machine tool,
- operation and maintenance (e.g. of the machines and equipment necessary for machine manufacturing),
- preparation of the final product, and
- production of fuels, steam and other energy carriers used in core processes (see section 4.6.3.2).

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:

- manufacturing of production equipment, buildings and other capital goods,
- business travel of personnel,
- travel to and from work by personnel, and
- research and development activities.

4.2.1.3. Downstream processes

All relevant unit processes shall be included, for example:

- transportation of the product to retailer/consumer,
- eventual foundation trenches,
- lifetime operation of the product including energy and material consumptions and emissions (e.g. machine parts replacements, coolant, ancillary products etc.),
- maintenance, replacements of machine elements, during RLS (Reference Service Life),
- revamping activities including substitution of key modules of the machine,
- disassembling of the product,
- end-of-life treatment of the used product after use phase and final disassembly, and
- end-of-life processes of packaging waste and any wasted part of the product.

4.2.2 OTHER BOUNDARY SETTING

4.2.2.1. Boundary towards nature

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

4.2.2.2. 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 0 for further guidance.

4.2.2.3. 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.

4.2.2.4. 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.

4.3 SYSTEM DIAGRAM

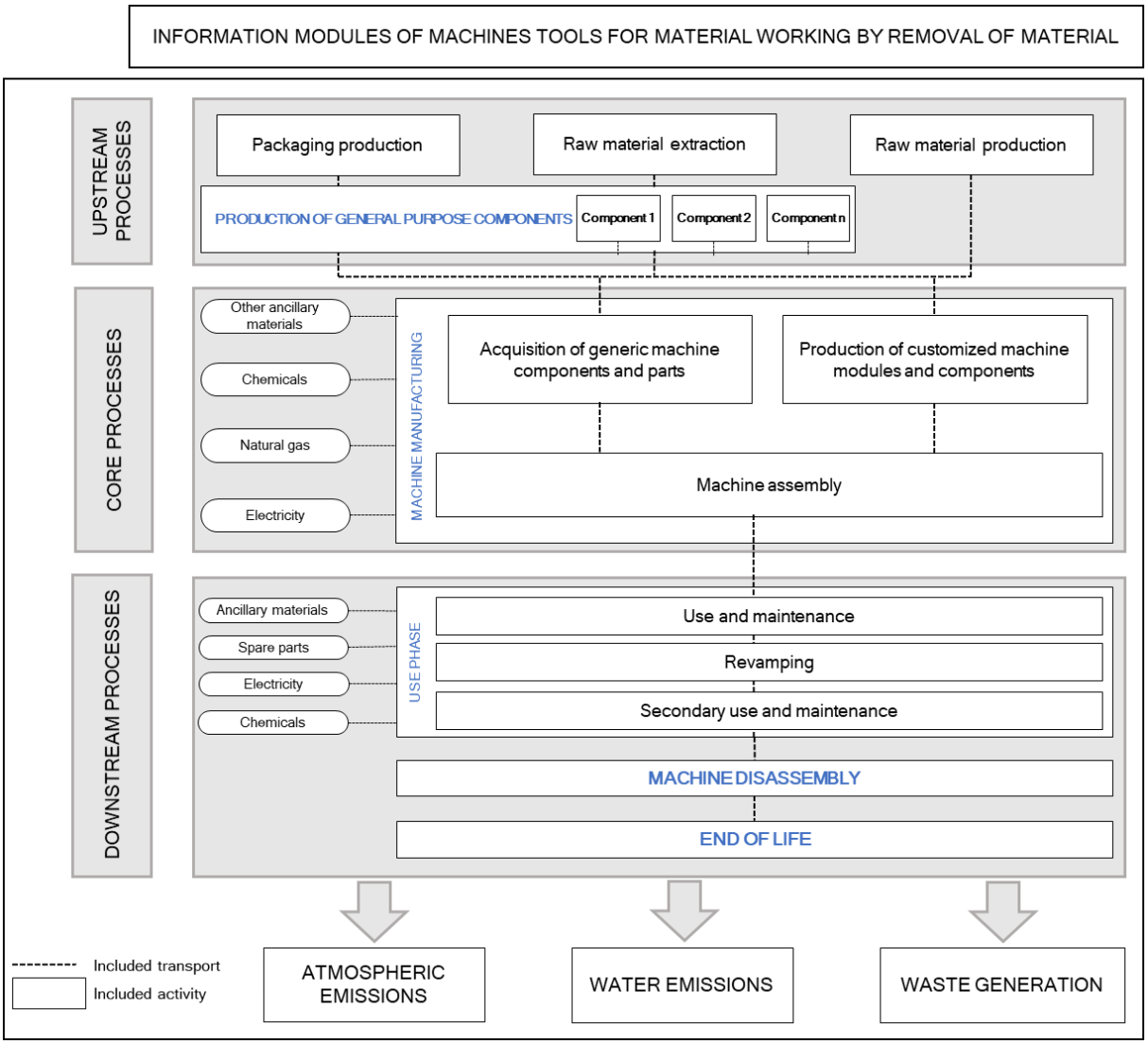

Figure 2 *System diagram illustrating the processes that are included in the product system, divided into upstream, core and downstream processes.*

Modularity is a key characteristic of different machine for removing material. Each machine can be configured in a specific model and further changes in its structure can be performed along its lifetime.

4.4 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 4.2) 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 experience of similar product systems. Further, the cut-off shall be possible to verify in the verification process, hence the exclusion of inventory data based on the cut-off rule shall be documented in the LCA report, and the EPD developer shall provide the information the verifier considers necessary to verify the cut-off.

4.5 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 0).

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

4.5.1 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, **Fel! Hittar inte referenskälla.** provides specific allocation guidance.

PROCESS	MAIN PRODUCT AND CO-PRODUCTS	ALLOCATION INSTRUCTION
Finishing	Processed items	Surface area (m^2)
Machining	Main parts and components of other equipments	Time of machining (h)
Painting	Main parts and components of other equipments	Painted area (m^2)
Auxiliary energy consumptions	Main parts and components of other equipments	Man-hour (h)
Valuable scrap	Processing scraps sold as secondary raw material at a specific economic value	Economic Value (Actual Currency)

Table 5 General criteria for subdivision of key processes in the product system, if steps 1 and 2 are not possible.

4.5.2 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.

4.6 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 generic data or proxy data. The data categories are defined as follows:

- specific data (also referred to as “primary data” or “site-specific data”):
  - data gathered from the actual manufacturing plant where product-specific processes are carried out;
  - actual data from other parts of the life cycle traced to the product under study, for example site-specific data on the production of materials or generation of electricity provided by contracted suppliers, and transportation data on distances, means of transportation, load factor, fuel consumption, etc., of contracted transportation providers; and
  - LCI data from databases on transportation and energy ware that is combined with actual transportation and energy parameters as listed above.
- generic data (sometimes referred to as “secondary data”), divided into:
  - selected generic data: data (e.g. commercial databases and free databases) that fulfil prescribed data quality requirements for precision, completeness, and representativeness (see below Section 4.6.1),
  - 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.

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. Any deviation should be declared.

4.6.1 RULES FOR USING GENERIC DATA

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

- datasets shall be based on attributional LCA modelling (e.g., not be based on marginal data and not include credits from system expansion),
- the reference year shall be as current as possible and should be representative for the validity period of the EPD,
- the 1% cut-off rule (as described in Section A.3.3 of the GPI) 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 must identify the unit processes represented by generic and specific data not meeting precision, completeness, representativeness criteria given in this PCR.

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

4.6.2 EXAMPLES OF DATABASES FOR GENERIC DATA

Table 6 lists examples of databases and datasets to be used for generic data. Please note that a data quality assessment shall be performed also for data listed in the table, and that other data that fulfil the data quality requirements may also be used.

Table 6: Examples of databases and datasets to use for generic data.

PROCESS	GEOGRAPHICAL SCOPE	DATASET	DATABASE
Steel and metal components, unspecified composition	Global	market for steel, chromium steel 18/8, hot rolled | steel, chromium steel 18/8, hot rolled | Cutoff, U - GLO	Ecoinvent
Unknown chromium steel manufacturing processes	European	metal working, average for chromium steel product manufacturing | metal working, average for chromium steel product manufacturing | Cutoff, U - RER	Ecoinvent
Unknown steel manufacturing processes or single steel item	European	metal working, average for steel product manufacturing | metal working, average for steel product manufacturing | Cutoff, U - RER	Ecoinvent
Unknown copper manufacturing processes	European	metal working, average for copper product manufacturing | metal working, average for copper product manufacturing | Cutoff, U - RER	Ecoinvent
Unknown metal manufacturing processes	European	metal working, average for metal product manufacturing | metal working, average for metal product manufacturing | Cutoff, U - RER	Ecoinvent
Unknown aluminium manufacturing processes	European	metal working, average for aluminium product manufacturing | metal working, average for aluminium product manufacturing | Cutoff, U - RER	Ecoinvent
Programmable Logic Controllers and electronics within laser drives	Global	market for printed wiring board, surface mounted, unspecified, Pb containing | printed wiring board, surface mounted, unspecified, Pb containing | Cutoff, U - GLO	Ecoinvent
Ethernet cables	Global	market for cable, network cable, category 5, without plugs | cable, network cable, category 5, without plugs | Cutoff, U - GLO	Ecoinvent
Power cables	Global	market for cable, three-conductor cable | cable, three-conductor cable | Cutoff, U - GLO	Ecoinvent
Cables, unspecified type	Global	market for cable, unspecified | cable, unspecified | Cutoff, U - GLO	Ecoinvent
Rubber and polymeric items	Global	Depending of the polymer type	Ecoinvent
Unknown copper manufacturing processes	European	metal working, average for copper product manufacturing | metal working, average for copper product manufacturing | Cutoff, U - RER	Ecoinvent
Unknown metal manufacturing processes	European	metal working, average for metal product manufacturing | metal working, average for metal product manufacturing | Cutoff, U - RER	Ecoinvent
Unknown alumiunium manufacturing processes	European	metal working, average for aluminium product manufacturing | metal working, average for aluminium product manufacturing | Cutoff, U - RER	Ecoinvent

In addition, electricity demand in the use phase should be modelled according to the priority indicated by section 4.6.3.2. National residual mixes should be employed if available (e.g. within European countries), otherwise the national mix can be employed.

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

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

4.6.3.1. Upstream processes

- Data referring to processes and activities upstream in a supply chain over which an organisation has 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 4.6).
- For upstream processes modelled with specific data, generation of electricity used shall be accounted for in this priority:

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

    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 may correspond a national electricity market, if this can be justified.

    The mix of electricity used in upstream processes shall be documented in the EPD, where relevant.
- Packaging: specific data shall be used for the consumer packaging production if it is under the direct control of the organization or if the environmental impact related to the consumer packaging production is more than 10% of the total product environmental 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.

4.6.3.2. Core processes

- Transport from the final delivery point of raw materials, chemicals, main parts, packaging (if applicable) 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.

    The processes listed below for the mechanical assembly and electric installation shall be included (where applicable):

    - Machining (energy inputs, chemical products and other consumables consumption, water consumption, waste generation and diffuse emissions). Production of machined parts shall be included under upstream processes, as well as, the amount of scraped material.

- Painting (energy inputs, chemical products and other consumables consumption, water consumption, waste generation and diffuse emissions,). Production of painted parts shall be included under upstream processes.
- Mechanical assembly and electric/hydraulic installation (energy inputs, chemical products and other consumables consumption, waste generation). Production of electric/hydraulic component shall be included under upstream process.

- Soldering (energy inputs, chemical products and other consumables consumption and diffuse emissions, transport of chemical products and consumables from immediate supplier to core factory). Production of soldered parts shall be included under upstream processes.
- For electricity used in the core processes, generation of electricity used shall be accounted for in this priority:

    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market.
    4. Electricity consumption mix on the market. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control[5].

    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 may correspond a national electricity market, if this can be justified.

    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.

4.6.3.3. Downstream processes

The following requirements apply to the downstream processes:

Use stage

- Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant.
- Data on the pollutant emissions from the use stage should be based on documented tests, verified studies in conjunction with average or typical product use, or recommendations concerning suitable product use. Whenever applicable, test methods shall be internationally recognised.
- Experimental data for electricity consumption in the use phase should be based on a use scenario, which shall be defined and declared into EPD.
- Information on the installed power, average power factor, active power (W) of experimental data must be reported in the LCA study as further support to assessment of power consumption.
- Additional processing tools (i.e. laser actuator) and spare/ware parts during its RLS must be included (material & secondary processing) in the LCA scope. Information on planned maintenance over the life time of the machine should be used as the basis.
- The use of water, chemicals and any ancillary material and fluid (e.g. inert gas, electroerosion oil etc.) by the machine during the use phase shall be calculated based on the defined use scenario.
- The number of activity hours has to be declared in LCA and EPD.
- The use of electricity in the region/country where the product is used (as specified in the geographical scope of the EPD) shall be accounted for in the following priority:

    1. National residual electricity mix or residual mix on the market
    2. National electricity production mix or electricity mix on the market

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

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

- The transport of the product to the customer shall be described in the reference PCR, which should reflect the actual situation to the best extent possible. The following priority should be used:

    1. Actual transportation distances and types.
    2. Calculated as the average distance of a product of that product type transported by different means of transport modes.
    3. A default transportation scenario calculated by the means of default data as a fixed long transport: 10 000 km by ship from the production plant to the main destination country, 500 km from the port to the distribution center by lorry and 1 000 km by lorry to the retailer.

Revamping

- 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: revamping activity. Revamping activity can include the substitution of major modules, their transportation and dismissal and replacement of new modules with the same or improved features.

End of Life

- 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.
- Due to the B2B (business to business) characteristics of this product it can be assumed, that the end-of-life machine 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 down-stream recycling quotas can be anticipated.
- The external metal structure of the machine is subject to re-use and recycling. Re-use of some specific internal component can be realized under specific circumstances. In addition, internal components for recycling represent a remarkable intrinsic value due to the scrap metal values, so high down-stream recycling quotas can be anticipated.

Recommendations for source separation and recycling can be given, as well as recommendations for other waste treatment of product parts if relevant.

4.6.4 DATA QUALITY DECLARATION

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

4.7 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 characterisations factors used shall be reported in the EPD. Alternative regional 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.

If the default list of environmental performance indicators and methods at the http://www.environdec.com 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, 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.

The alignment/adoption of indicators from the external product category rules does not imply that the EPDs can be claimed to be aligned or compliant with the external product category rules. Alignment/compliant with external product category rules requires alignment/compliant of the entire method applied, and not just the selection of indicators.

4.8 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

4.8.1 PRODUCTS FROM THE SAME COMPANY

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 included in the same EPD if none of the declared environmental performance indicators differ by more than 10% between any of the included products. The results for the environmental performance indicators of one representative product shall be declared according to Section 5.4.5. The choice of representative product shall be justified in the EPD, using, where applicable, statistical parameters.

4.8.2 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 http://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[6].

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[7] 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.

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

[7] 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.[8]
  - 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)
- Additional environmental information (see Section 5.4.6)
- Additional social and economic information (see Section 5.4.7)
- References (see Section 5.4.9)

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[9]
- Date of publication (issue): 20XX-YY-ZZ

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

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

- Date of revision: 20XX-YY-ZZ, when applicable
- Date of validity; 20XX-YY-ZZ
- A note that *"An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at http://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.
- For construction product EPDs:

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: mailto: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[10] and the PCR in a table with the following format and contents (see Table 7):

Table 7: Template of table to be used for information about verification and PCR

Product category rules (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>*
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☐ EPD verification ☐ Pre-verified tool
In case of certification bodies: Accredited by: *<name of the accreditation body and accreditation number, if applicable>.* *In case of individual verifiers:* *<Name, and organisation of the individual verifier. The signature may also be included>* Approved by: The International EPD® System

[10] 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.

The procedure for follow-up during EPD validity, as defined in the GPI, involves third-party verifier: ☐ Yes ☐ No

5.4.3 PRODUCT INFORMATION

The product information section of the EPD shall include:

- address and contact information to EPD owner,
- description of the organisation. This may include information on products- or management system-related certifications (e.g. ISO 14024 Type I environmental labels, ISO 9001- and 14001-certificates and EMAS-registrations) and other relevant work the organisation wants to communicate (e.g. SA 8000, supply-chain management and social responsibility),
- name and location of production site,
- product identification by name, and an unambiguous identification of the product by standards, concessions or other means,
- identification of the product according to the UN CPC scheme system. Other relevant codes for product classification may also be included, e.g.
  - Common Procurement Vocabulary (CPV),
  - United Nations Standard Products and Services Code® (UNSPSC),
  - Classification of Products by Activity (NACE/CPA),
  - 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 4.8),
- 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),[11] 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, Authorization, and Restriction of Chemicals (REACH);
- 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; and
- Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment Text with EEA relevance (for electrical part)

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. Table 8 provides a template to collect the recommended information of chemical preparations applied in the process.

COMMUNICATED PREPARATION	HAZARD IDENTIFICATION OF THE PREPARATION LISTED ON MSDS	SUBSTANCES AND RISK PHRASES LISTED ON MSDS	SUBSTANCES AND RISK PHRASES OF CONCERNED

Table 8 Identification and replacement of chemical substance by approximation

Information of very high concern substances (candidate list) if present shall be reported also with regards to the use phase.

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 re-utilization (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.

[11] The GHS document is available at http://www.unece.org.

- In case pre-consumer or post-consumer materials is used within the machine is necessary to mention the source of information for such data.

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).

Final packaging can be the outcome of eco-design processes, or other activities, under direct control of the organisation. The type and function of packaging shall be reported in the EPD. Packaging of machine regards procedure of intermediate disassembly of the machine, transportation and assembly nearby final user facility.

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.

5.4.5 ENVIRONMENTAL PERFORMANCE

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 http://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

In order to enforce information about the product, relevant Type I and Type II environmental labels awarded and recognized at international level to the product may be stated. Any claims made about the product shall be verifiable.

As annex, specific LCA sensitivity analysis of the machine can be reported to better clarify environmental performance of the machine under declaration.

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

- 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 General Programme Instructions (including version number), standards and PCR (registration number, name and version) used to develop the EPD. The source and version of the characterisation models and the factors used shall be reported in 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 Accessory
ANZSIC	Australian and New Zealand Standard Industrial Classification
B2B	Business to Business
CFP	Carbon Footprint of Products
CNC	Computer Numerical Control
CO_2	Carbon dioxide
CPC	Central Product Classification
CPV	Common Procurement Vocabulary
EC	European Commission
EEA	European Environment Agency
EN	European Standards
EPD	Environmental Product Declaration
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GLO	Global
GPI	General Programme Instructions
GTIN	Global Trade Item Number
ISO	International Organization for Standardization
KEITI	Korea Environmental Industry & Technology Institute
kg	kilogram
JEMAI	Japan Environmental Management Association for Industry
LCA	Life cycle assessment
LCI	Life cycle inventory
MOD	Structural/Functional module
NACE/CPA	Classification of Products by Activity
NC	Numerical Control
ND	Not Declared
PCR	Product Category Rules
PEF	Product Environmental Footprint
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RER	Europe
RSL	Reference service life
SI	The International System of Units
SO_2	Sulphur dioxide
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 the product category of construction products.

EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems

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

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

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

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

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

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

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

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

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

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

ISO (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 environmental labelling).

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 14955-1:2017 Machine tools -- Environmental evaluation of machine tools -- Part 1: Design methodology for energy-efficient machine tools.

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

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

Schischke K, Hohwieler E, Feitscher R, König J, Kreuschner S, Wilpert P, Nissen NF (2012) 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.

Special-Purpose Machinery version 2.5, dated 2015-12-22 (CPC 44), PCR Basic Module

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

8 VERSION HISTORY OF PCR

VERSION 1.0, 2021-12-21

Original version of the PCR

VERSION 1.0.1, 2022-01-10

Editorial changes to the original version of the PCR.

VERSION 1.0.2, 2022-05-26

Editorial changes, including a changed name of the PCR, to clarify the scope of the PCR in relation to other PCRs in the International EPD System.

VERSION 1.0.3, 2022-06-01

Editorial changes, including removal of one of the listed underlying studies.

MACHINE-TOOLS FOR MATERIAL WORKING BY REMOVAL OF MATERIAL
PRODUCT CATEGORY CLASSIFICATION: UN CPC 44211