THE INTERNATIONAL EPD COOPERATION (IEC)

EPD®

SUPPORTING ANNEXES

FOR ENVIRONMENTAL PRODUCT DECLARATIONS, EPD

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SUPPORTING ANNEXES
for
an international EPD®system
for environmental product declarations

This part of the documentation to the International EPD®system deals with various types of supporting information separated into the following Annexes:
- *Annex A Application of LCA methodology*
- *Annex B Conversion and characterisation factors*
- *Annex C PMI - A classification scheme for product categories*
- *Annex D Guidance on developing PCR documents (to be provided later)*
- *Annex E Guidance on communicating EPD information (to be provided later)*
- *Annex F Guidance on interpreting EPD information (to be provided later)*

ANNEX A: APPLICATION OF LCA METHODOLOGY

Contents:

A.1 Introduction

An LCA study consists of different stages with regard to the calculations and assessment procedures – goal and scope definition, inventory analysis, impact assessment and interpretation. In traditional LCA studies all background conditions with regard to the LCA calculations have to be defined from the onset of the study.

For an EPD, the preconditions for the LCA calculations are set from the beginning and described in the programme instructions with further specifications in the Product Category

Rules (PCR) document when defining the requirements to be followed. Hence, the development of an EPD does not have to go through an extensive and complete LCA study, but rather to follow the requirements given in the PCR documents, where all the necessary background assumptions are made and justified, and the associated calculations rules defined for the purpose of the application of EPDs. The LCA work done or an EPD is hence much more straightforward and time- and cost-efficient.

The LCA calculations rules described in this section outlines the overall requirements to follow for the international EPD®system. These rules follow the international standards ISO 14040 (*LCA - Principles and procedures*) and ISO 14044 (*LCA - Requirements and guidelines*).

A.2 Separation of the LCA calculations rules into different steps

The choice of methods to be used in the inventory analysis often has a major influence on the final results. It is therefore important to specify in detail how the calculations should be carried out. The inventory analysis should give results that are readily transferable for different basic calculations, and the results should be possible to add up with other similar input data from other information modules, PCR modules and EPDs.

In practice, LCA calculations are made differently for the separate LCA stages due to various types of background assumptions, different data availability, different accuracies of the calculated data and different needs for data representativeness and quality. Typically, available data are those from the manufacturing processes which an organisation usually has to regularly report on. These data are usually those being most company- and product-specific. However, product-specific data can also be collected if it includes production processes in the supply chain over which the organisation has management control, including the packaging and transportation used to deliver the product to a retailer or an end consumer. In most cases there is a lack of specific data covering all the information needs in an EPD. Here, generic data and scenario techniques may be used – some of which are precise enough to comply with the overall rules commonly set in EPD programmes.

Based on these realities, the international EPD®system has adopted an LCA calculations procedure which is separated into different life cycle stages:
- Upstream processes (from cradle-to-gate)
- Manufacturing processes (from gate-to-gate)
- Downstream processes (from gate-to-grave)

The main reason for separating these stages is based on the modularity approach chosen and the technical LCA-based calculations aspects described above, which has to be made differently depending on availability of specific information about the product and product category under study. Not only the origin and data specificity differ in the LCA calculations making up an EPD, also a large number of background assumptions such as functional unit, system boundary settings, cut-off criteria and allocation rules may be different as a consequence of the different quality of the data to be used.

Depending on the various types and main focus of an EPD a so-called “core module” is defined is to highlight where in the life cycle it is expected that the most specific LCA data can be available and delivered by an organisation. Usually the core module is equal to the manufacturing of goods.

With regard to the possibility for EPDs to describe the environmental performance of services, making the use of the products in the centre of the calculation similar to a "core module" (see below Chapter A.4.1) it seems logical to separate downstream processes into two distinct stages – product usage (including operations and maintenance) and end-of-life (including waste handling, incineration, recycling, re-use and deposition). In a full life cycle perspective, an EPD could be regarded to be bundled into 4 separate stages as illustrated below in Figure A.1. Often, more specifically for interim products and parts, refining of the materials and manufacturing is however consisting of more than one EPD, linked along the supply-chain.

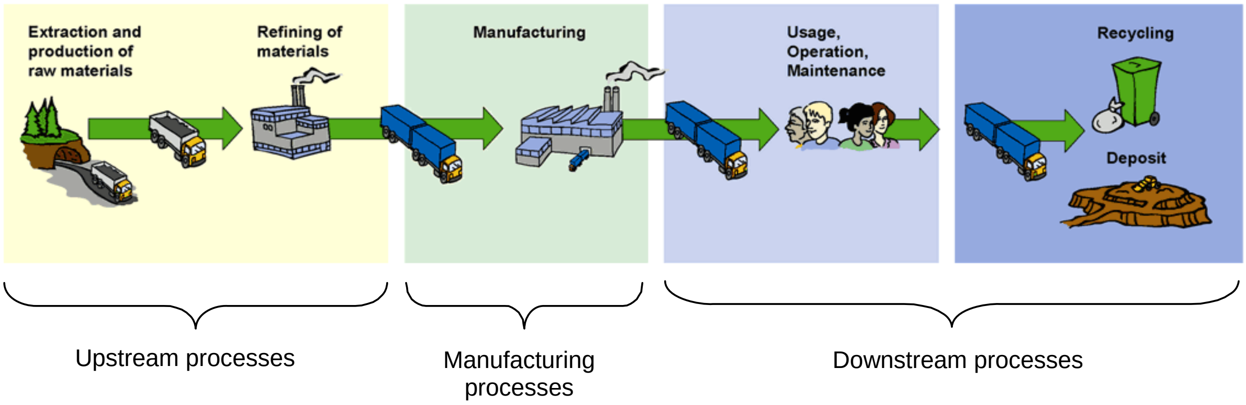

Figure A.1 The life cycle of a product divided into different stages

Another reason to be mentioned for separating the life cycle into different stages is the fact that it has been judged to be practical from the point of view to deliver a staged approach for preparing an EPD based on the PCR documents. Hence, the rules given in the PCR documents will be separated accordingly - for further information, see Annex D: Guidance for developing PCR documents.

A.3 Functional unit/declared unit

The functional unit is the reference unit used to quantify the performance of a product system. The main purpose of the functional unit is to provide a reference to which the inputs and outputs can be linked. The functional unit is important as a basis for the collection, handling and calculation of LCA data to ensure the possibility to "add up" information from EPDs in the supply chain and to be able to compare EPDs within a given product category. Usually comparability rests with the functional unit implying a full life cycle approach – from cradle-to-grave.

The preferred functional unit must be defined and measurable. In practice the functional unit consists of a qualitatively defined function or property (e.g. outer wall surface coverage with a certain level of brightness, for paint) and its quantification via a unit (e.g. 1 m^2). As a general rule, the functional unit shall be expressed in SI units (kg, J, meters etc.). Other units could be used in case they are considered more relevant to address the information (e.g. kW for power and kWh for energy). In order to increase the understanding and usefulness of an EPD, it might be an advantage to define the functional unit according to standardised LCA procedures supplemented with a technical specification of one product unit with parameters relevant for mainly addressing the performance of the product during its use.

For EPDs not covering a full life cycle, e.g. for building products where their further fate and function in terms of product use are unknown, the concept of functional unit is transferred into a so-called declared unit.

A product/product system may in fact have a large number of possible functions, and the function selected for the study depends on the objective and range of application. Therefore, it should be noted that the use of a product classification system with the objective to identify different products, such as the CPC scheme in the international EPD®system, could not automatically be used as a reference for comparisons.

A.3.1 Definition of functional unit/declared unit

The functional unit is defined as a quantified performance of the product for use as a reference unit in an environmental declaration of the life cycle of a product. A declared unit is defined as a quantity of a product for use as a reference unit for an environmental declaration based on an information module, where an information module is compilation of data covering a unit process or a combination of unit processes that are part of a life cycle for a product.

A.3.2 Technical specification

The technical specification shall include information sufficient for a customer to assess and evaluate the technical performance and usefulness of a product. The reference service life of a product should be taken into account in the selection of the functional unit. The lifespan in technical terms, i.e. the time for which a product has been designed to last, expressed in relevant units such as years, operating hours or kilometres travelled, is to prefer. If the technical reference service life is difficult to determine, other approximations of the reference service life may be acceptable. The choice of such a term other than the technical reference service life should be clearly justified. Note that the technical service life is not identical or related to guarantee time whether legally binding or offered voluntary. In the case of products that have an actual reference service life being shorter than the technical reference service life, (e.g. as due to changes in fashion the product is discarded before its technical service life has been reached), the estimate on actual reference service life shall be used instead.

Functional unit/declared unit

Core module:

For the manufacturing processes of goods the basic rule should be to declare the product according to the technical specification. For material-type products, the standard technical specifications should be used as part of the functional unit. Hence, the functional unit could be defined as one product unit, e.g. 1 refrigerator or 1 tonne of manufactured pulp. For cases such as the refrigerator, size classes of the product should be required to improve comparability.

For services the basic rule should be to declare the expected functional outcome of the service provided, i.e. treatment of a defined volume of wastewater, laundry of a defined mass of clothing or the painting of a defined wall area.

Downstream processes:

For the use stage, in case of EPDs for goods, other rules for defining the functional unit may have to be applied using scenario techniques, where important aspects to consider are to refer to the technical performance and the expected reference service life of the product. The chosen scenarios should reflect situations occurring under realistic conditions. It should always be possible to relate the functional/declared unit of the downstream processes to the functional/declared unit of the core module.

A.4 System boundaries

The system boundaries determine the unit processes to be included in the study and what type of "upstream data and downstream data" that could be omitted. System boundary settings are usually made case-wise in the PCRs and reduce the number of required LCA data thereby facilitating the calculations provided that no significant information is lost.

As a general principle all processes "from cradle to grave" shall be included in the study. For products, where their further use is not known, e.g. a building product a "from cradle to gate" approach is usually sufficient with regard to the scope of the EPD for which a declared unit shall be defined/described. For "end-products" a "cradle to grave"-approach is usually relevant, however, with due consideration to the principles of the book-keeping systems approach as advocated in the international EPD®system (see below Chapter A.7 Allocation rules).

The same general principles apply for EPDs for services since any service activity has to make use of physical resources. In this case, the "production of the service" is regarded as the "core module" instead of the manufacturing processes. The more pronounced difference between goods and services with regard to the PCR work is most likely the relatively distinct focus on defining the responsibilities of the service provider in their use of products, which a service provider to some extent has a management control over. Therefore, actual activities taking place in using products can be more detailed described in contrast to the general scenarios usually dealt with for EPDs for goods.

Deviations from any general rule described above for system boundary settings shall be avoided and if necessary be duly justified in the PCR document.

Detailed rules for the selection of system boundaries are described in ISO 14044. When setting system boundaries for an EPD, it is to prefer to use the principle of "limited loss of information at the final product" – see below Chapter A.5.

A.4.1 Specifications of different boundary settings

The following specifications of different boundary settings are relevant:

Boundary in time shall define/describe the time period, for which the LCI data are recorded, e.g. how long emissions from waste deposits are accounted for.

Boundary towards nature shall define the flow of material and energy resources from nature into the technical system and emissions from the technical system to air, soil and water[1].

[1] Agricultural and similar production systems are part of the technical system, i.e. the elementary flows that leave the field to water or air are to be recorded.

Boundary towards geography shall define/describe the geographical coverage of the LCA data including possibilities to handle different regional aspects in the supply chain, if found necessary.

Boundaries in the life cycle shall define/describe what to be included with regards to e.g. extraction and production of raw materials, refining of raw materials, manufacturing of components and main parts, assembly of products, use of products, and end-of-life processes.

- *Upstream processes*: All relevant unit processes along the upstream supply-chain shall be included – this covers e.g. extraction and refining of raw materials and production of semi-manufactured goods. Also relevant services shall be included such as 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.
- *Manufacturing processes*: All relevant unit processes taking place within the organisation of the product for which the EPD is issued for shall be included – this covers e.g. transport from for the final delivery of main parts and components (see above re. upstream processes) to the manufacturing plant. Also treatment of wastes generated within the process should be included in this module, while it may be carried out by third parties. Generally, building of a production site, infrastructure, production of manufacturing equipment and personnel activities need not be included. However, where the building of a production site or manufacturing equipment make up a reasonable portion of the overall environmental impact (e.g. for photovoltaic equipment or windpower) or for a service activity, the "Upstream infrastructure" and "Downstream infrastructure" i.e. construction and dismantling of necessary equipment including reinvestments during the life cycle should be considered as well. To identify the relevance of infrastructure the commonly defined cut-off rules shall be applied. This overall approach is illustrated below in Fig. A.2:

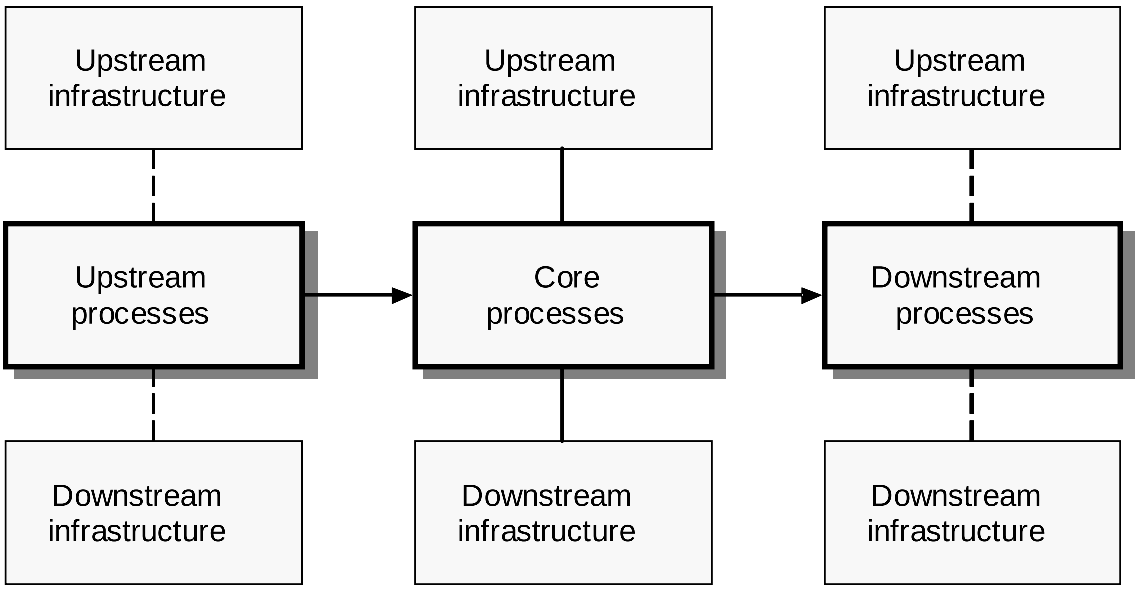

Figure A.2 Outline of the division between LCA stages and the need to consider infrastructure elements for specific EPD applications

- *Downstream processes*: All relevant unit processes shall be included – this covers e.g. transport of the product to the retailer/consumer, consumption/loss of electricity and maintenance according to manual instructions when using the product (with indications regarding which environmental impact from maintenance and production of spare parts that is taken into consideration), and end-of-life processes of the used product. If a service is identified as a core process it does not typically have a downstream process as e.g. generated waste is included in the core module.

Boundaries towards other technical systems shall define/describe the flow of materials and components from the product system under study and the outflow of materials to other systems. If there is an inflow of recycled material to the product system in the production/manufacturing stage, the transport from the scrap yard/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 scrap yard/collection site shall be included. The material or component going to recycling is then an outflow from the product system. For more information – see also below Chapter A.7.

A.5 Criteria for the inclusion of inputs and outputs (cut-off criteria)

It is important to clarify and describe rules for omitting inventory data which are negligible from the point of view of being relevant in the study. Such so-called cut-off criteria are usually expressed as a specific percentage of the total environmental impact for any impact category that is allowed to be omitted from the inventory analysis. The rules set should be based on the inflow of product and elementary flows to the system and outflow of elementary flows from the system. Other cut-off criteria are discouraged and if these should be recommended in the PCR this has to be duly justified, e.g. in the case of service activities.

It is important to emphasize that, in most cases, all available data shall be used. Using cut-off rules should not give the perceptions of “hiding” information, but rather to facilitate the data collection for practitioners. It is important to document parts and materials not included in the LCA.

Cut-off rules
Upstream and core processes: A default value of a cut-off rule of 1% regarding energy, mass and environmental relevance shall apply. This means that for the overall LCI result of the product 99% of the elementary flows by energy content, mass and environmental relevance are included. Changes to this general rule shall be considered in the PCR document but avoided and if done duly justified.

Downstream processes: No need for pre-set cut-off rules as the calculations are based on well-defined scenarios.

It should be noted that the only way to check for cut-off rules in a satisfactory way is combination of expert judgement based on experience in similar product systems and a sensitivity analysis in which it is possible to understand how the un-investigated input or output could affect the final LCI and LCIA result.

A.6 Description of data and data quality requirements

The data to be used in the LCA-based information could be classified into three categories - *specific data*, *selected generic data* and *other generic data*, defined as follows:

- specific data (also referred to as primary data) - data gathered from the actual manufacturing plant where product-specific processes are carried out, and data from other parts of the life cycle traced to the specific product system under study, e.g. materials or electricity provided from a contracted supplier being able to provide data for the actual delivered services, transportation taking place based on the actual fuel consumption and related emissions etc. (*Note! a more comprehensive description is under development*)
- selected generic data (also referred to as secondary data) – data from commonly available data sources (e.g. commercial databases and free databases), which are allowed to be used to substitute specific data providing they fulfil prescribed characteristics (see below Chapter A.6.1)
- other generic data - data coming from other generic data sources.

As a general rule, specific data shall always be used if available. It is mandatory to be used for the core process, i.e. "the manufacturing processes for goods or service execution/provision of services" as defined more above. For the "upstream" and "downstream processes" and "infrastructure" (as defined in more detail above) also generic data may be used if specific data is lacking. Generic data should especially be used in cases where they are representative for the purpose of the EPD, e.g. for bulk and raw materials on a spot market, if there is a lack of specific data on the final product or if a product consists of many components.

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

A.6.1 Rules for using generic data

The book-keeping LCA approach in the international EPD®system forms the basic prerequisites for selecting generic data. For allowing the use of selected generic data[2] selected prescribed characteristics for precision, completeness and representativeness must be fulfilled and demonstrated such as:
- *Reference year* to be as actual as possible, preferably being representative for at least 2002,
- *Cut off criteria* to be met on the level of the modelled product system are the qualitative coverage of at least 99% of-both the energy, the mass, and the overall relevance of the flows,
- *Completeness* where the inventory data set should in principle cover all elementary flows that contribute to a relevant degree of the impact categories, and
- *Representativeness* of the resulting inventory for the good or service in the given geographical reference should, as a general principle, be better than ± 5 %.

[2] The international EPD®system specifically recognises the value and usefulness of the availability of background LCI databases with a wide range of high quality and consistent data, especially if the data is regionally differentiated. To ensure the quality and consistency of the background data, requirements should be set programme-wide. Such requirements exist in a draft version and are presently under finalisation by the European Platform on LCA in a wide stakeholder process intended to be put in place for the international EPD®system by mid 2008. The European Commission's ELCD core database (European Reference Life Cycle Data System) applies these rules and any third party database developer can make its own data as ELCD-consistent data available, meeting the same quality and documentation requirements, as well as review requirements of these data meeting both the needs for data quality and independency of individual database developers.

Suitable databases for selected generic data include information about the material flows connected to a number of input materials. Admissible data has to respect the boundaries set in the PCR as well as to meet the requirements of the international EPD®system for data quality, representativeness, review and scope of documentation. If based on these prerequisites, recommendations are given to use selected generic data, such data sources shall be listed in a table in the reference PCR document. Before making use of suitable databases, it is important to primarily select information given separate over the different life cycle stages and, beyond all, to check that the data is free from inclusion of data and calculations outside the system boundaries. Data calculated with system expansion should not be used, but if no other data is available, any “negative flows” should be changed to zero.

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

Data quality requirements

Upstream processes:

- Data referring to processes and activities upstream in the supply chain, over which an organisation has a direct management control, shall be specific and collected on site
- Data referring to contractors supplying main parts or main auxiliaries should be asked for from the contractor as specific data, as well as infrastructure, if relevant.
- Transport of main parts and components along the supply-chain to a distribution point (e.g. a stockroom or warehouse) where the final delivery to the manufacturer can take place based on the actual transportation mode, distance from the supplier and vehicle load.
- In case specific data is lacking, selected data may be used. If this is also lacking, other generic data may be used – see above.

Core processes:

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

Downstream processes:

With regard to data quality requirements for the *use stage* usually based on scenarios, the following shall apply:

- 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.
- The use of the energy mix in the region/country where the product is sold and then used shall be approximated as the OECD electricity mix. For non-OECD countries, in order to adopt a suitable region- or country-specific electricity mix (reflecting approximately the

region(s)/countries' share) a similar precision will be required. The mix shall be documented.
- The mix shall be documented.
- Transport of the product to customer shall, as a first option be based on the actual transportation distances. As a second option, it could be calculated as the average distance of a product of that product type transported with different means of transport or, if also such data is not available be calculated as a fixed long transport such as e.g.1000 km distance transport with lorry or 10000 km by airplane, according to product type. The way transportation shall be calculated shall be described in the reference PCR, which should reflect the actual situation to the best extent possible.

With regard to data quality requirements for the *end-of-life stage* based on scenarios, the following shall apply for the information being:
- technically and economically practicable, and
- compliant with current regulations.

A.7 Allocation rules

Allocation is the partitioning of input or output flows of a process or other product systems to the product system under study. Hence, the inputs and outputs must be allocated to the different products according to clearly stated procedures that shall be documented and explained.

As a general rule, the allocation method chosen should be as valid as possible for the whole product system. However, allocation within the manufacturing processes and downstream processes may to be treated somewhat different.

Allocation rules must be defined for individual products when the manufacturing processes result in many different kinds of products and where there is only aggregate information available about the total level of emissions. Collection of product-specific information under such circumstances is to prefer to avoid allocation. The method of avoiding allocation by expanding the system boundaries, as advocated in ISO 14044, is not applicable within the framework of the international EPD®system due to the rationale of the book-keeping LCA approach (attributional LCA) used and the concept of modularity.

When choosing allocation rules the following principles can be recommended:
- *Multi-input*: allocation based on physical causal relationships, i.e. relationship between how the pollutant emission from the process is affected by changes in the input flows.
- *Multi-output*: allocation based on the way in which resource use and pollutant emissions change following quantitative modifications in products or functions delivered by the system being studied.
- *Open loop recycling*: no allocation should be made for materials subject to recycling. Inputs of recycled materials or energy to a product system shall be included in the data set without adding their data about environmental impact caused in "earlier" life cycles. Hence, outputs of products subject to recycling shall be regarded as inputs to the "next" life cycle.

Other allocation rules relevant for selected sub-processes may be defined and justified in the reference PCR document. In the event of different available options, a sensitivity analysis may help select the most relevant allocation method. An underlying study report should contain a comprehensive description of the method(s) used.

A.7.1 Handling of wastes, treatment of worn-out products and output flows that are reused or recycled

Wastes in a broader sense including scrapped materials, used chemicals, wastes, wastewater and worn-out products can be subject to:

- Waste incineration
- Waste or wastewater treatment
- Composting
- Deposition
- Recycling
- Reuse

The various handling options call for a general principle to follow for the allocation of the environmental burdens between product systems with the following basic points of departure:

- The environmental impact connected to the treatment of wastes not being used by any subsequent user rests with the generator of the waste - hence, the waste is not considered as a resource
- The environmental impact connected to the processing of the waste into a resource for a subsequent user rests with the user of the resulting resource

This approach links together different product systems where wastes, fully or to some extent, are being further processed to become input materials for subsequent product systems. The delineation between two product systems is considered to be the point where the waste has its "lowest market value". This means that the generator of the waste has to carry the full environmental impact until the point in the product´s life cycle where the waste is transported to a scrap yard or gate of a waste processing plant (collection site). The subsequent user of the waste has to carry the environmental impact from the processing and refinement of the waste, but not the environmental impact caused in the "earlier" life cycles. This approach referred to as the "Polluter-Pays (PP) allocation method" has the following definition: *The "PP allocation method" designates the responsibility to carry upcoming environmental impact for individual product systems and separates interlinked product systems at the pointing in the life cycle where they have their lowest market value resulting in a business-related approach regarding the differentiation of environmental impacts*. The "PP allocation method" is also (in most cases) in line with a waste generator's juridical and financial responsibilities. The method is illustrated as a general approach in Figure A.3 below:

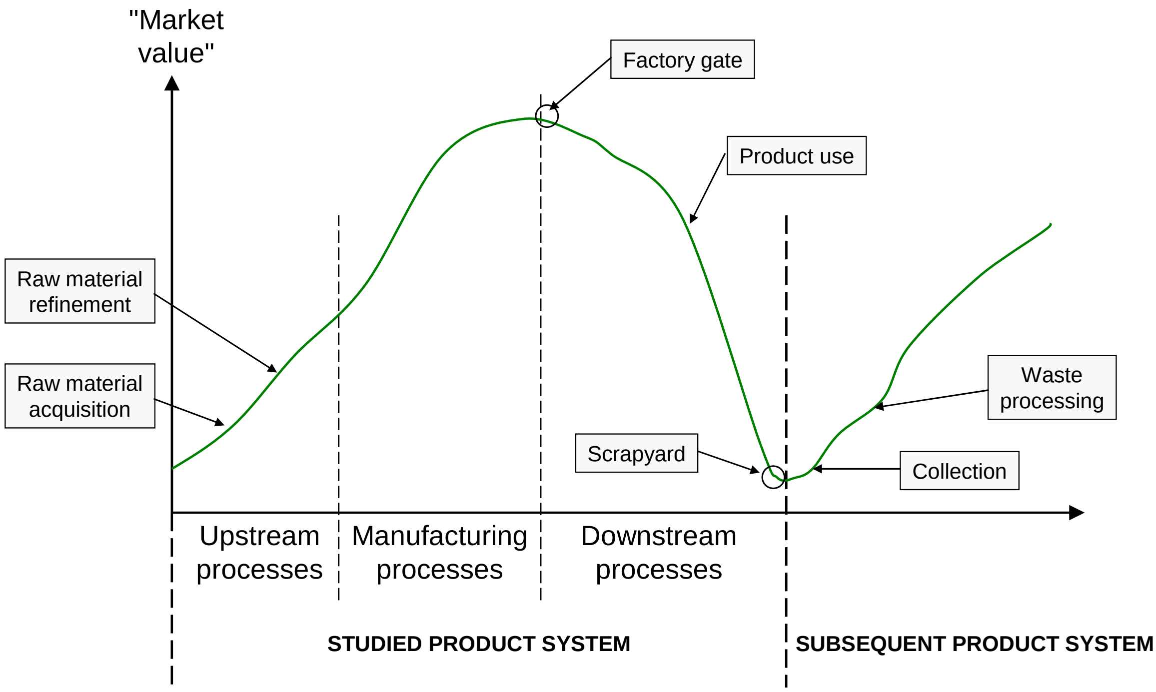

Figure A.3 Outline of the "the PP allocation method"

The "PP allocation method" is further illustrated below in Figure A.4 by describing the consequences for the different types of handling of wastes, treatment of worn-out products and output flows that are reused or recycled.

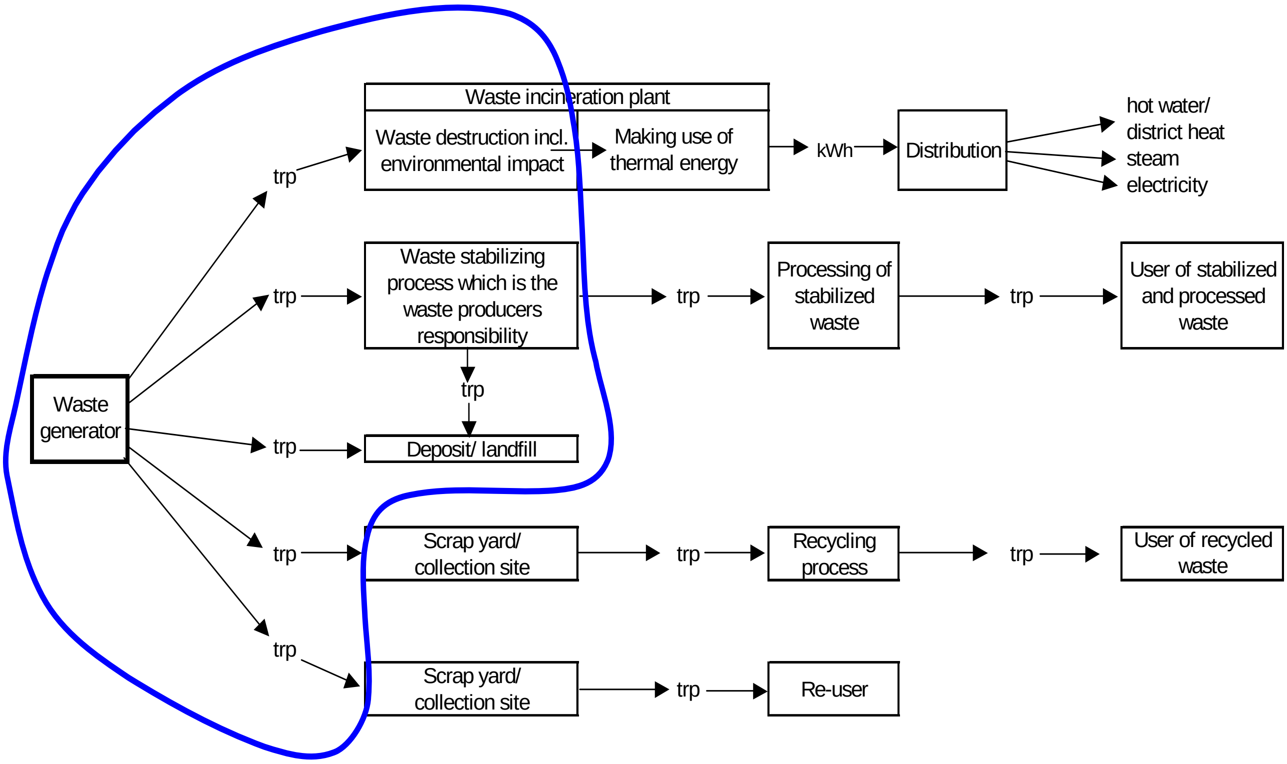

Figure A.4 The "PP allocation method" illustrated for the various types of waste treatment options included in various process stages. The encircled area indicates the environmental impact that has to be carried by the waste generator

If the suggested "PP allocation method" causes problems from the point of view of giving an accurate description of the environmental benefits of a product, there is a possibility to address product-specific allocation rules and justify this in the PCR document and present an additional approach with quantitative information in the EPD under "Additional environmental information".

<u>Handling of input flows that are by-products or wastes from suppliers' processes</u>
It is sometimes difficult to decide if an input flow of materials should be considered being a waste or a by-product from a supplier, i.e. if there should be any environmental impact allocated to that material or not. If the waste/by-product constitutes a substantial part of the waste/by-product generator's overall revenues, it should be considered a by-product and some environmental impact should be allocated to it. If the waste/by-product does not constitute a substantial part of the waste/by-product generator's overall revenues, it should be considered a waste and treated according to the principles of the PP allocation method. Consequently, a waste flow from a supplier that can be used without affecting the waste generator's process is free of environmental burden for the user i.e. no environmental burden shall be allocated from an industry's process to wastewater that else would have been emitted to a recipient. Handling of input flows that are by-products or wastes from suppliers' processes should as far as possible be handled in the reference PCR for the product category.

<u>Example</u>: Sawdust from a sawmill might constitute 7% of the overall revenues of the sawmill since such sawdust could be asked for as a bio-fuel for combustion plants. On the other hand, sawdust from a furniture industry might constitute <1% of the overall revenues since the furniture are highly

processed products with a much higher price. In the first case the sawdust should be considered a by-product, whereas in the second case the sawdust is considered a waste.

Waste incineration

Incineration of waste results in a waste destruction service and commodities such as steam, hot water, and electricity. The environmental impacts of collecting and transportation of the waste to the incineration plant as well as those impacts caused by the incineration process itself are allocated to the waste generator, whereas equipment and processes needed to make use of the produced heat (if that is practised) e.g. to produce district heat or electricity, is allocated to the party benefiting from those commodities (Fig. A.5).

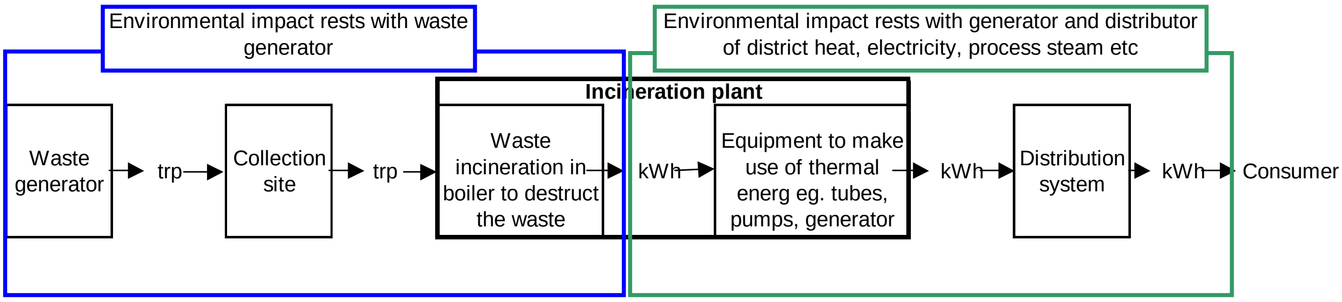

Figure A.5 The PP allocation method regarding incineration of waste and possible resulting energy products

Waste and wastewater treatment

The environmental impact of transportation of waste or wastewater to a plant for treatment or stabilization as well as those impacts caused by the treatment process itself, ending up on a deposit/landfill as sludge or discharge of sewage effluent rests with the waste generator. However, in case the stabilized wastes are refined for use as e.g. fertilizers, the environmental impact connected to the further processing of the waste is allocated to the user of the processed waste.

Deposition

The environmental impact of transportation of the waste to the deposit/landfill rests with the generator of the waste. Hence, no allocation is needed. It should be noted that the environmental impact from leakage from the deposit/landfill is usually considered difficult to estimate with any reasonable accuracy. In case data with sufficient accuracy is available the resultant environmental impact shall be considered.

Composting

The environmental impact of transportation of waste to a composting plant rests with the waste generator as well as the environmental impact resulting from the composting process itself. In case the composted material, or emissions from it, are further processed/refined for commercial/beneficial purposes, the resultant environmental impacts is allocated to the party benefiting from those commodities.

Recycling
Used materials subject to recycling are considered to leave the product system under study free of environmental burdens during the life cycle, i.e., the environmental impacts from the production are allocated to the product system under study. The further processing of the materials are allocated to the next product system which will be using the recycled materials as material input such as collection (if the recycled material is not transported to the recycling plant), treatment and further refinement of the input materials (scrap) as illustrated below in Fig. A.6:

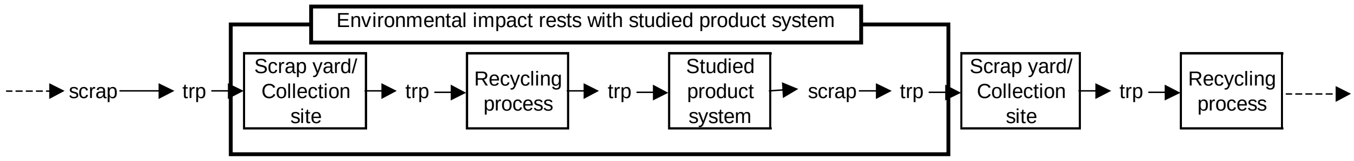

Figure A.6 The PP allocation method regarding inputs made of recycled materials and outputs of materials that will be recycled.

If the main function of a recycling process cannot be properly defined (e.g. delivering both recycled resources and waste treatment services as well as heat), special rules and requirements of how to handle such calculations has to be defined and described in the reference PCR document.

Re-use
The environmental impact of transportation of the used product for re-use by another party to some sort of collection site rests with the producer of the product, i.e. wastes that are re-used leave the product system without any environmental burdens. All environmental impact from there on is allocated to the re-user.

A.8 Data processing for reporting

The data collected are meant to be used to report on the consumptions and emissions calculated during the inventory analysis phase and to convert the raw data into potential impacts for various pre-selected environmental effects on a regional or global scale as identified in the impact assessment stage. As advocated in the ISO 14025, it is important to separate EPD information being either generated from the inventory analysis or further processed through impact assessment calculations.

EPD information shall also include, where relevant, so-called additional environmental information, related to environmental issues other than the environmental information from PCR information modules, LCI- or LCA-calculations. This information shall be separated from other parts of the EPD and has to comply with a number of requirements associated with the recommendations given in ISO 14021 on “Self-declared environmental claims”. As a consequence of this, it is recommended that an organisation keep good track of and as well as a record of the necessary background information supporting the data given for other environmental information.

For information about what type of data and information to be included in the EPD – see Chapter 3: Declaration requirements and format.

ANNEX B: CONVERSION AND CHARACTERISATION FACTORS

Contents:

This Annex lists conversion and characterisation factors to be used for converting LCI data into resource use and potential environmental impacts. The Annex will undergo revisions and updating when found necessary[3].

B.1 Conversion factors for calculation of Gross Calorific Values (GCV)

Values of resources with energy content expressed in MJ/functional unit making use of the Gross Calorific Values (GCV).

Ref. OECD, IEA, Eurostat "Energy Statistics Manual" 2004. IEA Publications September 2004.

Hard coals	***GCV (MJ/kg)***
Anthracite	30,00
Coking coals	29,30
Other bituminous	25,30
Cokes	***GCV (MJ/kg)***
Metallurgical coke	27,90
Gas coke	28,35
Low-temperature coke	26,30
Petroleum coke (green)	33,15
Coal-derived gases	***GCV (MJ/kg)***
Coke oven gas	19,01
Blast furnace gas	2,89
Petroleum products	***GCV (MJ/kg)***
Ethane	51,90
Propane	50,32
Butane	49,51
LPG [1)]	50,08
Naphtha	47,73
Aviation gasoline	47,40
Motor gasoline [2)]	47,10
Aviation turbine fuel	46,23
Other kerosene	46,23
Gas/diesel oil	45,66
Fuel oil, low sulphur	44,40

[3]The European Platform on LCA has an ongoing project for the definition of recommended LCIA framework, impacts and methods, due by mid-2008. These outcomes will result from a broad stakeholder consultation to ensure a general consensus among the LCA community on existing impact categories as well as for additional impact categories to be included in PCRs

Fuel oil, high sulphur	43,76
Natural gas	***GCV (MJ/kg)***
Methane	55,52 (MJ/kg)
Methane	xx (MJ/Nm^3)
Others	***GCV (MJ/kg)***
Uranium	Fission energy 451.000 MJ/kg 3)
Biomass	

1) Assumes a mixture of 70% propane and 30% butane by mass.
2) An average for motor gasoline with RON between 91 and 95.
3) Source: In case other reference values are considered, it shall be justified the use in the LCA study report.

Impact potentials are calculated as the sum of the contributions of the impacts shown in the inventory analysis, each one multiplied by a coefficient called the *"characterisation factor,"* which indicates the scale of the potential contributed by the individual substance to the effect. Operationally speaking, it is thus necessary to use the characterisation factors shown in the tables that follow, indicating the results of the multiplication, substance by substance.

Some data missing

B.2 Characterisation factors for greenhouse gases

Global Warming Potentials (mass basis) for the time horizon 100 years, CO_2-equivalents.

Ref: IPCC (Intergovernmental Panel on Climatic Change), Climate Change 2001: the Scientific Basis. Cambridge University Press, Cambridge UK.

Gas	**Chemical composition**	**Global Warming Potential Time horizon 100 years**
Carbon dioxide	CO_2	1
Methane	CH_4	23
Nitrous oxide	N_2O	296
Chlorofluorocarbons		
CFC-11	CCl_3F	4600
CFC-12	CCl_2F_2	10600
CFC-13	$CClF_3$	14000
CFC-113	CCl_2FCClF_2	6000
CFC-114	$CClF_2CClF_2$	9800
CFC-115	CF_3CClF_2	7200
Hydrochlorofluorocarbons		
HCFC-21	$CHCl_2F$	210
HCFC-22	$CHClF_2$	1700
HCFC-123	CF_3CHCl_2	120
HCFC-124	CF_3CHClF	620
HCFC-141b	CH_3CCl_2F	700
HCFC-142b	CH_3CClF_2	2400
HCFC-225ca	$CF_3CF_2CHCl_2$	180
HCFC-225cb	$CClF_2CF_2CHClF$	620
Hydrofluorocarbons		
HFC-23	CHF_3	12000
HFC-32	CH_2F_2	550
HFC-41	CH_3F	97
HFC-125	CHF_2CF_3	3400
HFC-134	CHF_2CHF_2	1100
HFC-134a	CH_2FCF_3	1300
HFC-143	CHF_2CH_2F	330
HFC-143a	CF_3CH_3	4300
HFC-152	CH_2FCH_2F	43
HFC-152a	CH_3CHF_2	120
HFC-161	CH_3CH_2F	12
HFC-227ea	CF_3CHFCF_3	3500
HFC-236cb	$CH_2FCF_2CF_3$	1300
HFC-236ea	CHF_2CHFCF_3	1200
HFC-236fa	$CF_3CH_2CF_3$	9400
HFC-245ca	$CH_2FCF_2CHF_2$	640
HFC-245fa	$CHF_2CH_2CF_3$	950

Gas	Chemical composition	Global Warming Potential Time horizon 100 years
HFC-365mfc	$CF_3CH_2CF_2CH_3$	890
HFC-43-10mee	$CF_3CHFCHFCF_2CF_3$	1500
Chlorocarbons		
CH_3CCl_3		140
CCl_4		1800
$CHCl_3$		30
CH_3Cl		16
CH_2Cl_2		10
Bromocarbons		
CH_3Br		5
CH_2Br_2		1
$CHBrF_2$		470
Halon-1211	$CBrClF_2$	1300
Halon-1301	$CBrF_3$	6900
Iodocarbons		
CF_3I		1
Fully fluorinated species		
SF_6		22200
CF_4		5700
C_2F_6		11900
C_3F_8		8600
C_4F_{10}		8600
c-C_4F_8		10000
C_5F_{12}		8900
C_6F_{14}		9000
Ethers and Halogenated Ethers		
CH_3OCH_3		1
$(CF_3)_2CFOCH_3$		330
$(CF_3)CH_2OH$		57
$CF_3CF_2CH_2OH$		40
$(CF_3)_2CHOH$		190
HFE-125	CF_3OCHF_2	14900
HFE-134	CHF_2OCHF_2	6100
HFE-143a	CH_3OCF_3	750
HCFE-235da2	$CF_3CHClOCHF_2$	340
HFE-245cb2	$CF_3CF_2OCH_3$	580
HFE-245fa2	$CF_3CH_2OCHF_2$	570
HFE-254cb2	$CHF_2CF_2OCH_3$	30
HFE-347mcc3	$CF_3CF_2CF_2OCH_3$	480
HFE-356pcf3	$CHF_2CF_2CH_2OCHF_2$	430
HFE-374pc2	$CHF_2CF_2OCH_2CH_3$	540
HFE-7100	$C_4F_9OCH_3$	390
HFE-7200	$C_4F_9OC_2H_5$	55
H-Galden 1040x	$CHF_2OCF_2OC_2F_4OCHF_2$	1800
HG-10	$CHF_2CHF_2OCF_2OCHF_2$	2700
HG-01	$CHFOCFCFCHFOCFCFOCHF_2$	1500

Note: Factors for sulphuric acids and other compounds are planned to be included

B.1 Characterisation factors for ozone-depleting gases

Semi-empirical polar ozone depletion potentials (ODP) for the time horizon 20 years, CFC-11 equivalents.

Ref: Solomon & Albritton, 1992, in Nordic Guidelines on Life-Cycle Assessment, Nord 1995:20, Nordic council of Ministers, Copenhagen.

Species	Formula	ODP [kg CFC-11 eq./kg]
Bromo-methane	CH_3Br	2.30
CFC-11 (Trichlorofluoromethane)	$CFCl_3$	1
CFC-113	$C_2F_3Cl_3$	0.59
HALON-1211	$CClF_2Br$	9
HALON-1301	CF_3Br	10.50
HALON-2402	$C_2F_4Br_2$	11

HCFC-123	$CHCl_2CF_3$	0.08
HCFC-124	$CHFClCF_3$	0.08
HCFC-141b	CH_3CFCl_2	0.33
HCFC-142b	CH_3CF_2Cl	0.14
HCFC-22	CHF_2Cl	0.14
HCFC-225ca	$C_3HCl_2F_5$	0.10
HCFC-225cb	$C_3HCl_2F_5$	0.11
Tetrachloromethane	CCl_4	1.23
Trichloroethane	CH_3CCl_3	0.45

B.2 Characterisation factors for acidifying compounds

Acidification (incl. fate, average Europe total), expressed as Acidification Potential (AP) in kg SO_2 eq; baseline.

Ref: (CML, 1999); (Huijbregts, 1999; average Europe total, A&B).

Substance	*Cas no.*	*Unit*	*kg SO_2 eq.*
Ammonia	7664-41-7	kg	1,60E+00
Nitrogen dioxide	10102-44-0	kg	5,00E-01
Nitrogen oxides (as NO_2)	11104-93-1	kg	5,00E-01
Sulphur dioxide	7446-09-5	kg	1,00E+00
Sulphur oxides	-	kg	1,00E+00

B.3 Characterisation factors for gases creating ground-level ozone

<u>POCP, non-specific hydrocarbons, g ethene-equivalents/g VOC-mix.</u>

*Ref: * Ref: Heijungs et al., 1992, in Nordic Guidelines on Life-Cycle Assessment, Nord 1995:20, Nordic council of Ministers, Copenhagen.*
*** Ref: Andersson-Sköld et al., 1992, in Environmental Assessment of Products, Institute for Product Development, Copenhagen, Denmark.*

VOC-mix	POCP
Hydrocarbons (average)	0.337*
Non-methane hydrocarbons (average)	0.416*
Petrol car, combustion emissions	0.46**
Petrol car, evaporation	0.42**
Diesel car, combustion emission	0.48**
Stationary combustion	0.44**
Use of solvents	0.29**
Industrial processes	0.27**
Oil refinement and distribution	0.42**
Leakage of natural gas	0.24**

<u>Photochemical Ozone Creation Potentials (POCP) as ethene-equivalents.</u>

Photochemical oxidation (high NOx)

Ref: POCP (Jenkin & Hayman, 1999; Derwent et al. 1998; high NOx); baseline (CML, 1999)

Substance	*Cas no.*	*group*	*unit*	*kg ethylene eq.*
Sulphur dioxide	7446-09-5	inorganic	kg	4,8E-02
Ethylbenzene	100-41-4	aromatic	kg	7,3E-01
Styrene	100-42-5	aromatic	kg	1,4E-01
Benzaldehyde	100-52-7	aromatic	kg	-9,20E-02

Substance	***Cas no.***	***group***	***unit***	***kg ethylene eq.***
nitrogen mono oxide	10102-43-9	inorganic	kg	-4,27E-01
nitrogen dioxide	10102-44-0	inorganic	kg	2,8E-02
1-Propyl Benzene	103-65-1	aromatic	kg	6,36E-01
sec-Butyl Acetate	105-46-4	nonaromatic (ester)	kg	2,75E-01
para-Xylene	106-42-3	aromatic	kg	1,0E+00
Butane	106-97-8	nonaromatic (alkane)	kg	3,52E-01
1-Butene	106-98-9	nonaromatic (alkane)	kg	1,08E+00
1,3-Butadiene	106-99-0	nonaromatic (alkene)	kg	8,5E-01
Ethylene Glycol	107-21-1	nonaromatic (ester)	kg	3,73E-01
Methyl Formate	107-31-3	nonaromatic (ester)	kg	2,70E-02
2-Methylpentane	107-83-5	nonaromatic (alkane)	kg	4,20E-01
Methyl propyl Ketone	107-87-9	nonaromatic (ketone)	kg	5,48E-01
1-Methoxy-2-propanol	107-98-2	nonaromatic (alcohol)	kg	3,55E-01
Methyl *Iso*butyl Ketone	108-10-1	nonaromatic (ketone)	kg	4,90E-01
Diisopropylether	108-20-3	nonaromatic (ether)	kg	3,98E-01
*iso*propyl acetate	108-21-4	nonaromatic (ester)	kg	2,11E-01
Meta-Xylene	108-38-3	aromatic	kg	1,1E+00
1,3,5-trimethylbenzene	108-67-8	aromatic	kg	1,38E+00
Toluene	108-88-3	aromatic	kg	6,4E-01
Cyclohexanol	108-93-0	nonaromatic (alcohol)	kg	5,18E-01
Cyclohexanone	108-94-1	nonaromatic (alkane)	kg	2,99E-01
1-Propylacetate	109-60-4	nonaromatic (ester)	kg	2,82E-01
Pentane	109-66-0	nonaromatic (alkane)	kg	3,95E-01
1-Pentene	109-67-1	nonaromatic (alkene)	kg	9,77E-01
2-Methoxy-Ethanol	109-86-4	nonaromatic (alcohol)	kg	3,07E-01
Dimethoxy methane	109-87-5		kg	1,6E-01
Hexane	110-54-3	nonaromatic (alkane)	kg	4,82E-01
Valeraldehyde	110-62-3	nonaromatic (aldehyde)	kg	7,65E-01
2-Ethoxy-Ethanol	110-80-5	nonaromatic (alcohol)	kg	3,86E-01
Cyclohexane	110-82-7	nonaromatic (alkane)	kg	2,90E-01
Octane	111-65-9	nonaromatic (alkane)	kg	4,53E-01
2-Butoxy-Ethanol	111-76-2	nonaromatic (alkane)	kg	4,83E-01
Nonane	111-84-2	nonaromatic (alkane)	kg	4,14E-01
1-Undecane	1120-21-4	nonaromatic (alkane)	kg	3,84E-01
Dodecane	112-40-3	nonaromatic (alkane)	kg	3,57E-01
Propylene	115-07-1	nonaromatic (alkene)	kg	1,12E+00
Dimethyl Ether	115-10-6	nonaromatic (ether)	kg	1,89E-01
*iso*butene	115-11-7	nonaromatic (alkene)	kg	6,27E-01
Propionaldehyde	123-38-6	nonaromatic (aldehyde)	kg	7,98E-01
Diacetone alcohol	123-42-2	nonaromatic (alcohol)	kg	3,07E-01
3-Methylbutan-1-ol	123-51-3	nonaromatic (alcohol)	kg	4,33E-01
Butyraldehyde	123-72-8	nonaromatic (aldehyde)	kg	7,95E-01
1-Butyl Acetate	123-86-4	nonaromatic (ester)	kg	2,69E-01
Decane	124-18-5	nonaromatic (alkane)	kg	3,84E-01
tetrachloroethylene	127-18-4	haloginated nonaromatic	kg	2,9E-02
2-Methylbutan-1-ol	137-32-6	nonaromatic (alcohol)	kg	4,89E-01
Ethyl Acetate	141-78-6	nonaromatic (ester)	kg	2,09E-01
Heptane	142-82-5	nonaromatic (alkane)	kg	4,94E-01
cis-Dichloroethene	156-59-2	haloginated nonaromatic	kg	4,47E-01
trans-dichloroethene	156-60-5	haloginated nonaromatic	kg	3,92E-01
Methyl *tert*-Butyl Ether	1634-04-4	nonaromatic (ether)	kg	1,75E-01

Substance	*Cas no.*	*group*	*unit*	*kg ethylene eq.*
3,5-Diethyltoluene	25550-13-4	aromatic	kg	1,30E+00
3,5-Dimethylethylbenzene	29224-55-3	aromatic	kg	1,32E+00
trans-2-Hexene	4050-45-7	nonaromatic (alkene)	kg	1,07E+00
Neopentane	463-82-1	nonaromatic (alkane)	kg	1,73E-01
Formaldehyde	50-00-0	nonaromatic (aldehyde)	kg	5,2E-01
2-Methyl-2-Butene	513-35-9	nonaromatic (alkene)	kg	8,42E-01
1,2,3-Trimethyl Benzene	526-73-8	haloginated aromatic	kg	1,27E+00
tertiary-Butyl Acetate	540-88-5	nonaromatic (ester)	kg	5,30E-02
3-Methyl-1-Butene	563-45-1	nonaromatic (alkene)	kg	6,71E-01
2-Methyl-1-Butene	563-46-2	nonaromatic (alkene)	kg	7,71E-01
Methyl-Isopropylketone	563-80-4	nonaromatic (ketone)	kg	3,64E-01
1-Butoxypropanol	57018-52-7	nonaromatic (alcohol)	kg	4,63E-01
Propylene Glycol	57-55-6	nonaromatic (ester)	kg	4,57E-01
3-Pentanol	584-02-1	nonaromatic (alcohol)	kg	5,95E-01
3-Methylhexane	589-34-4	nonaromatic (alkane)	kg	3,64E-01
Hexan-3-one	589-38-8	nonaromatic (ketone)	kg	5,99E-01
cis-2-Butene	590-18-1	nonaromatic (alkene)	kg	1,15E+00
2-Methylhexane	591-76-4	nonaromatic (alkane)	kg	4,11E-01
Hexan-2-one	591-78-6	nonaromatic (ketone)	kg	5,72E-01
1-Hexene	592-41-6	nonaromatic (alkene)	kg	8,74E-01
3-Methylbutan-2-ol	598-75-4	nonaromatic (alcohol)	kg	4,06E-01
Diethyl Ether	60-29-7	nonaromatic (ether)	kg	4,45E-01
ortho-Ethyltoluene	611-14-3	aromatic	kg	8,98E-01
Dimethyl carbonate	616-38-6		kg	2,50E-02
meta-Ethyltoluene	620-14-4	aromatic	kg	1,02E+00
para-Ethyltoluene	622-96-8	aromatic	kg	9,06E-01
trans-2-Butene	624-64-6	nonaromatic (alkene)	kg	1,13E+00
cis-2-Pentene	627-20-3	nonaromatic (alkene)	kg	1,12E+00
Carbon Monoxide	630-08-0	inorganic	kg	2,70E-02
Ethyl- *trans*-Butyl Ether	637-92-3 0	nonaromatic (ether)	kg	2,44E-01
Ethanol	64-17-5	nonaromatic (alcohol)	kg	3,99E-01
Formic acid	64-18-6	nonaromatic (carboxylic acid)	kg	3,20E-02
Acetic acid	64-19-7	nonaromatic (carboxylic acid)	kg	9,70E-02
trans-2-Pentene	646-04-8	nonaromatic (alkene)	kg	1,12E+00
Methanol	67-56-1	nonaromatic (alcohol)	kg	1,40E-01
*iso*propanol	67-63-0	nonaromatic (alcohol)	kg	1,88E-01
Acetone	67-64-1	nonaromatic (ketone)	kg	9,40E-02
Trichloromethane	67-66-3	haloginated nonaromatic	kg	2,3E-02
1-Propanol	71-23-8	nonaromatic (alcohol)	kg	5,61E-01
1-Butanol	71-36-3	nonaromatic (alcohol)	kg	6,20E-01
Benzene	71-43-2	aromatic	kg	2,2E-01
1,1,1-trichloroethane	71-55-6	haloginated nonaromatic	kg	9,0E-03
Methane	74-82-8	nonaromatic (alkane)	kg	6,00E-03
Ethane	74-84-0	nonaromatic (alkane)	kg	1,23E-01
Ethylene	74-85-1	nonaromatic (alkene)	kg	1,0E+00
Acetylene	74-86-2	nonaromatic (alkyne)	kg	8,50E-02
Methyl Chloride	74-87-3	haloginated nonaromatic	kg	5,00E-03
Propane	74-98-6	nonaromatic (alkane)	kg	1,76E-01
Acetaldehyde	75-07-0	nonaromatic (alkane)	kg	6,41E-01
Dichloromethane	75-09-2	haloginated nonaromatic	kg	6,8E-02
*iso*butane	75-28-5	nonaromatic (alkane)	kg	3,07E-01

Substance	*Cas no.*	*group*	*unit*	*kg ethylene eq.*
tertiary-Butanol	75-65-0	nonaromatic (alcohol)	kg	1,06E-01
2,2-Dimethylbutane	75-83-2	nonaromatic (alkane)	kg	2,41E-01
2-Methylbutan-2-ol	75-85-4	nonaromatic (alcohol)	kg	2,28E-01
Methyl *tert*-butylketone	75-97-8	nonaromatic (ketone)	kg	3,23E-01
*iso*pentane	78-78-4	nonaromatic (alkane)	kg	4,05E-01
*iso*prene	78-79-5	nonaromatic (alkene)	kg	1,09E+00
*iso*butanol	78-83-1	nonaromatic (alcohol)	kg	3,60E-01
*iso*butyraldehyde	78-84-2	nonaromatic (aldehyde)	kg	5,14E-01
sec-Butanol	78-92-2	nonaromatic (alcohol)	kg	4,00E-01
2-butanone	78-93-3	nonaromatic (ketone)	kg	3,73E-01
Trichloroethylene	79-01-6	haloginated nonaromatic	kg	3,3E-01
Propanoic acid	79-09-4	nonaromatic (carboxylic acid)	kg	1,50E-01
Methyl Acetate	79-20-9	nonaromatic (ester)	kg	5,90E-02
2.3- Dimethylbutane	79-29-8	nonaromatic (alkane)	kg	5,41E-01
ortho-Xylene	95-47-6	aromatic	kg	1,1E+00
1,2,4-trimethylbenzene	95-63-6	haloginated aromatic	kg	1,28E+00
3-Methylpentane	96-14-0	nonaromatic (alkane)	kg	4,79E-01
Diethylketone	96-22-0	nonaromatic (ketone)	kg	4,14E-01
*iso*propyl benzene	98-82-8	aromatic	kg	5,00E-01
cis-2-Hexene	7688-21-3	nonaromatic (alkene)	kg	1,07E+00
Volatile Organic Compounds non-methane - (non methane VOC)(as ethylene)	NMVOC		kg	1,0E+00
Pentanaldehyde		nonaromatic (aldehyde)	kg	7,65E-01
3,5 diethyl toluene	*2050-24-0*		*kg*	*1,30E+00*
2-hexene (trans)	*4050-45-7*		*kg*	*1,07E+00*
Sulfur Oxides			*kg*	*4,80E-02*

When the POCP characterisation factor for a certain substance is not listed in Table 5.2, average value shall be used. For POCP calculation, average values are the following:

- Alcohols (average) 0.38
- Aldelhydes (average) 0.69
- Alkanes (average) 0.39
- Alkenes (average) 0.97
- Aromatics (average) 0.80
- Carboxylic acids (average) 0.093
- Esters (average) 0.22
- Ethers (average) 0.29
- Ketones (average) 0.42

(Average values calculated according to table 5.2 values including all substances classified into the specific category).

B.4 Characterisation factors for eutrophicating compounds

Eutrophication (fate not incl.), expressed as Eutrophication Potential (EP) in kg PO_4^{3-} eq, baseline.

Ref: (CML, 1999); (Heijungs et al. 1992).

Substance	*Cas no.*	*unit*	*kg PO_4^{3-} eq.*

Ammonia	7664-41-7	kg	3,50E-01
Ammonium	14798-03-9	kg	3,30E-01
Ammonium carbonate	*000506-87-6*	*kg*	*1,20E-01*
Ammonium nitrate	*006484-52-2*	*kg*	*7,40E-02*
Chemical oxigen demand (COD)	COD	kg	2,20E-02
Dinitrogen monoxide	*010024-97-2*	*kg*	*1,30E-01*
Nitrate	14797-55-8	kg	1,00E-01
nitric acid	7697-37-2	kg	1,00E-01
Nitrite	14797-65-0	kg	1,00E-01
Nitrogen	7727-37-9	kg	4,20E-01
nitrogen dioxide	10102-44-0	kg	1,30E-01
nitrogen mono oxide	10102-43-9	kg	2,00E-01
nitrogen oxides (as NO_2)	11104-93-1	kg	1,30E-01
Nitrogen, total	7727-37-9	kg	4,20E-01
Phosphate	14265-44-2	kg	1,00E+00
phosphoric acid	7664-38-2	kg	9,70E-01
Phosphorus	7723-14-0	kg	3,06E+00
Phosphorus(V)oxide (P_2O_5)	1314-56-3	kg	1,34E+00

ANNEX C: PMI – A CLASSIFICATION SCHEME FOR PRODUCT CATEGORIES

Contents:

C.1 Introduction

The international EPD®system introduces a classification scheme for harmonisation and structurisation of PCR documents referred to as the *PCR Module Initiative* (PMI). A general recognised classification scheme for the definition of product categories is of vital importance for a voluntary system with international applicability due to the need to identify PCR work under consideration as well as to facilitate the development of PCR documents and the handling and approval of the PCR review panel.

There exist a number of product classification schemes systems on the market such as CPA (*Classification of Products by Activity*), CPV (*Common Procurement Vocabulary*) and HS (*Harmonised Commodity Description and Coding System*), most of which are based on the NACE codes – an international system for the division of business sectors. A common denominator of these schemes is that they usually define a special product without any distinct relationship between them. CPC (Central Product Classification) is an UN-based scheme for statistical division of product categories and service types, which seems to be the best approach to use for establishing a PCR structure as it relates on supply chain/ life cycle approach. CPC is not meant to replace other product classification schemes, but aims primarily to a harmonisation of them. Hence, the CPC is a sort of a coordination instrument to be used both nationally and internationally.

C.2 The CPC scheme

CPC is a complete product classification scheme covering goods and services. It is based on the physical characteristics of goods or on the nature of the services rendered. Each type of good or service distinguished in the CPC is defined in such a way that it is normally produced by only one activity as defined in the *International Standard Industrial Classification of all economic activities* (ISIC Rev. 3). Conversely, each activity of the ISIC is defined in such a way that it normally produces only one type of product as defined in the CPC (where each type of product may have a number of individual products coded under it). So far as is practically possible, an attempt is made to establish a one-to-one correspondence between the two classifications, each category of the CPC being accompanied by a reference to the ISIC class in which the good or service is mainly produced. The CPC covers products that are an output of economic activities, including transportable goods, non-transportable goods and services.

The CPC scheme is, as far as possible, based on a hierarchic life cycle perspective, i.e. material, manufacture and products belong to the same group. Adding to the principles of other product classification schemes, CPC could be regarded as a hybrid between those and a formal life cycle system. The CPC scheme does not always start from the acquisition of raw materials, but instead offers a logical structure for the development of PCR documents. Assuming that the PCR documents are developed on a sector level, the CPC scheme is more logical than any other product classification scheme.

The CPC scheme has a wide coverage and there is one category for all products and services being traded on national and international markets. The codes used in the CPC scheme are hierarchic and purely decimal based, as a maximum, on digits:
- Sections – one digit code;
- Divisions – two-digit code;
- Groups – three-digit code;
- Classes – four-digit code;
- Subclasses – five-digit code

All in all, the CPC scheme consists of 10 sections, 71 divisions, 294 groups, 1162 classes and 2093 subclasses. CPC is now in a version 1.1 from 2002 and will be revised 2007 into a new version – 2.0. This revision will most likely not influence the overall framework but instead refine smaller details.

C.3 The CPC-based PCR structure

The PCR documents describe the type of information to be given about a product and the EPD from a life cycle perspective as well as how this information shall be generated. The CPC scheme provides an approach for coding information modules which linked together can describe a products life cycle. While the PCR document regulates how a full EPD can be generated for product categories, the CPC scheme is used for coding and defining the information modules.

An example of such an approach a PCR document is given below for “*Milk and milk-based products*”:

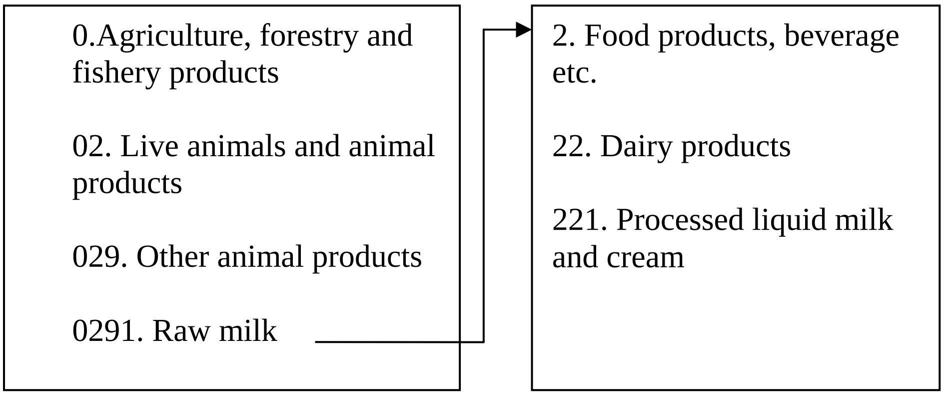

Figure C.1 Outline of the principles of the CPC classification scheme

The two-digit code (divisions) typically defines an industry specific product group (e.g. division 22. *Dairy products*) which may have a number of individual products coded under it (e.g. group 221. *Processed liquid milk and cream*). Thus, the two-digit code, and sometimes the one digit code, may be used to define industry specific information modules, which when combined build up specific product life-cycles in a horizontal dimension. Each one of these also provides an embedded vertical structure going from a general product group to more specific individual products.

The use of the CPC system leads to a structure for PCR documents in two dimensions:
- a “horizontal” dimension describing the product´s value chain divided according to business sectors, i.e. building on CPC-coded information modules, and
- a “vertical” dimension defining each information module (with a further delineation of each such section into subclasses).

C.3.1 Structuring the PCR document according to the LCA stages

The CPC concept forms the basis for a PCR structure to:
- provide a structure for industry specific PCR core modules, or rather the PCR core module and up-streams modules as well as down-streams modules within the product group system boundary, and
- open up for differentiated, but defined levels of requirements in the PCR document, i.e. part of the requirements may be applicable on a generic product group level, part of the requirements may be limited to selected individual products.

This approach is illustrated below where A stands for a raw material acquisition, B for semi-manufacturing of goods, C for the manufacturing of the product, E for use of the product and E for end-of-life treatment (EOL):

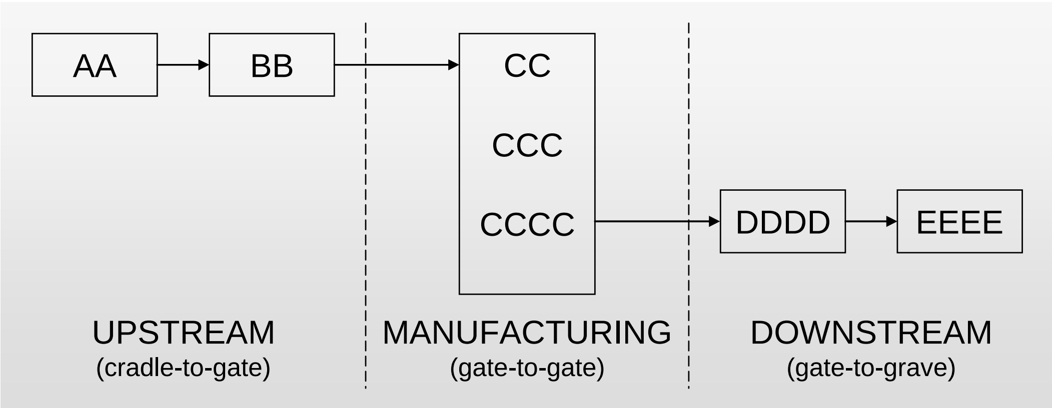

Figure C.2 Outline of the principles to apply the CPC classification scheme to the various life cycle stages

The PCR document should be structured accordingly, but this does not dramatically change the way the PCR document are currently outlined. However, it introduces a CPC-coded core information module offering both a homogeneous hierarchic structure to define the product group at different levels of details (vertical within the core module) as well as a distribution of "responsibilities for PCR work" between different branches (developed within other modules). The rationale behind this is that a specific industry sector/branch has the best knowledge and competence to develop the parts in the PCR document belonging to its own NACE-code (CPC code), but not usually not for other industry sectors (suppliers and customers). The PCR structure also enables the LCA calculations rules for different parts of handling the information within the core module to be placed on different hierarchic levels, also making it possible to develop information modules for rather "small" and specific product groups within a hierarchic system where substantial parts of the calculation rules have a more broader and general applicability.

A PCR structure following the CPC system can be used to clearly specify what type of data quality criteria to fulfil for each information module. It also will give a clear instruction about which product groups or system boundaries to choose in upcoming PCR development work. The CPC system will also help in separating the type of general PCR rules that are valid for most products and, hence, could be included in the overall PCR rules. For the suggested CPC structure, the PCR document will be referred to as "information modules" to be supplemented with other similar modules or relevant useful information, which is described below in more detail. The practical application of the PCR structure is given in Part 5, Annex C: Guidance on developing PCR documents.

The PCR upstream modules

The CPC scheme enables information modules upstream manufacturing to be clearly defined and provide a basis for setting the data quality requirements, regardless if such data are available or not. In most cases, in the early phase of the development of EPD programmes, there will be a lack of PCR documents for parts of the value chain upstream.

The following rules apply on a general basis:

- In case there exist PCR documents for upstream modules will these describe the requirements for system boundaries and data quality requirements for the collection and preparation of product- and supplier-specific data. If an actual EPD is available from a supplier, this information shall be used as a data source (or as a specification of demand for relevant data quality).

- In case there is a lack of relevant PCR documents or EPDs, selected generic data sources can be used and shall be referred to in the PCR document. If these selected generic data do not supply the required upstream information, other generic data, fulfilling the so-called “10%-rule” will be accepted to use (see Part 3.6.1). The CPC structure shall be used to clearly define the data quality requirements valid for each relevant information module.

These rules do not change the data quality requirements for upstream processes compared to the current premises, but rather offer a more logical structure easy to communicate.

The PCR core modules for gate-to-gate conditions

The CPC structure is based on information modules for gate-to-gate conditions supplemented with other information modules for the remaining part of the life cycle or different types of substitution information.

The vertical hierarchic separation in the CPC structure enables a similar separation to be made of the rules in the PCR document having the advantage of harmonisation between different products with principally the same origin. In the example given above for “Milk and milk-based products” is it plausible that the rules for the cradle-to-gate part of the LCA in most cases can be defined on a “division- or, in some cases, a group level” (i.e. for two- or three-digit codes), while the rules in the PCR document for complementary information maybe have to be defined on a lower level (i.e. three- to five digit codes).

By specifying requirements for a clear separation of different PCR rules, the development of highly specific and “small” PCR documents can be avoided. Making use of the CPC structure for “sections” and “divisions” will lead to products with a similar origin will be given a “industry section specific” hierarchic structure. This will substantially facilitate the PCR work concentrating the information module to the manufacturing of a selected industry sector.

The PCR downstream modules

The calculation rules for the PCR downstream modules are usually based on scenarios the use and end-of-life (EOL) stages. These rules are similar to the present PCR structure, but can in some cases, depending on the relevant characteristics for the product group under study, specify rules on a higher and more general coding level.