PEP ecopassport® PROGRAM

PCR

Product Category Rules
for
Electrical, Electronic and HVAC-R Products

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List of the editorial modifications of the present document

On 2016 02 02:

Party changed	Change made
chapter 2.5.6	Inert waste - source and link to ELCD dataset replace by « (source : Landfill of glass/inert waste ;landfill including leachate treatment and without collection, transport and pre-treatment ;at landfill site) »

Contents

1. Introduction

1.1. Scope

The specifications provided in this document are part of the type III environmental declaration program, entitled PEP ecopassport®, that provides an international reference framework for environmental declaration.

They constitute the Product Category Rules (PCR) of the program and define the rules for the development of Product Environmental Profiles (PEP) in compliance with ISO 14025[1] standard.

This PCR applies to "Electrical, Electronic and Heating Ventilation Air Conditioning-Refrigeration (HVAC-R) products" covered by the program, and include (but not limited to):

- Wires, cables and accessories for energy, signalling, telecommunications, data and precision,
- Solutions for electrical installations and home automation,
- Openings and closures management systems, heating, air conditioning and lighting equipment,
- Electronic material for persons and buildings security,
- Self-contained emergency lighting systems,
- Routing and cables protection equipment,
- Process and industrial automation,
- Indoor, outdoor lighting and public lighting,
- Equipment for renewable energies production,
- Electric heating equipment and electric water heaters,
- Heating and air conditioning equipment,
- Equipment for domestic hot water production,
- Ventilation and treatment of air equipment,

It describes the required rules to ensure that PEP created in the context of this type III environmental declaration program are correctly drawn up and published with verifiable, comparable and not misleading information.

Drawing up PEP requires a product Life Cycle Assessment (LCA) which has to be carried out in accordance with the rules described by ISO 14040[2] and ISO 14044[3] standards.

This reference document is mainly intended for:

- Product & Environment managers
- Company LCA experts responsible of drawing up PEP
- Verifiers responsible of assessing PEP conformity according to the rules defined in this reference document.

[1] ISO 14025 :2010. Environmental labels and declarations - Type III environmental declarations - Principles and procedures

[2] ISO 14040: 2006. Environmental management – Life cycle assessment – Principles and framework

[3] ISO 14044: 2006. Environmental management – Life cycle assessment – Requirements and guidelines

This document is the third version of the PCR that has been developed by the PEP ecopassport® program since 2009. From the best of our knowledge, no other program for Type III environmental declaration covering electrical, electronic and HVAC-R products is existing at the time PCR is published.

1.2. Contents of the document

This document includes the following parts:

- Common Rules to conduct Life Cycle Assessments

This part describes the common LCA rules to comply with for all the categories of products covered by the PEP ecopassport® program. It also specifies the requirements regarding data selection and quality.

- Description of the contents of LCA report

This part specifies the information that shall be included in the LCA report which brings together all the necessary data for the completion of the fulfilment of the LCA and the PEP.

- Product Environmental Profile editorial rules

This part describes the editorial guidelines to draw up PEP, i.e. the sections to be completed and the information to be provided.

- Appendices
  A. Definitions, calculation methods and characterization factors for environmental impact categories,
  B. Definition of the validity framework for a joint declaration,
  C. Diagram of the system boundaries for the LCA,
  D. Terms and definitions,
  E. Bibliography,
  F. Critical review.

The PCR is supplemented, if necessary, by additional Product-Specific Rules (PSR) defined for each product category covered by further standards that specifically explicit the functional units and additional information in relation to the common rules (e.g. use scenario).

Consequently, for a given product category, all the common rules and additional specific rules constitute a PCR for this category, as defined in ISO 14025 standard (see figure 1).

Figure 1: organization of PCR in PEP ecopassport® program

For products not covered by a PSR, the PCR rules shall be applied. It is recommended to contact the PEP ecopassport® program to identify the need for a PSR development regarding the specific product category and the processes to be followed.

The PCR as well as the different PSR are available from the PEP ecopassport program®.

2. Product Life Cycle Assessment

2.1. Functional unit and reference flow description

The functional unit is the reference unit used to quantify the performance of the service delivered by a product to the user. The main purpose of the functional unit is to provide a reference to which inputs and outputs are related in the LCA. The functional unit shall include:

- The identification of the product function(s) under study. The function(s) shall describe the service delivered to the user,
- The performance or requirement level achieved by the function(s). This level shall be quantified. It may be determined according to the standards applicable to the product,
- The reference life time (RLT).

The definition of the reference flow to fulfil the functional unit shall include:

- The quantification of the reference product and its mass (kg),
- The materials not found in the reference product that includes waste and discarded materials generated at each life cycle stage (manufacturing process, cutting, installation, etc.),
- All the packaging used during the reference life time,
- Elements, flows and processes required to distribute, install, use (maintenance, repairs, replacements…) remove, dismantle and treat the reference product.

Where appropriate, the definitions of the functional unit and the reference flow are given in the PSR. The declaring party shall define and specify the functional unit in the PEP and the reference flow in the LCA report, as defined in sections 3.3 and 4.1.4 of this document.

2.2. System boundaries

2.2.1. Presentation of modularity principle

All aspects related to production, transportation, installation, use and end-of-life, up to the final disposal of a flow required to supply the considered stage, shall be allocated to the corresponding stage.

Therefore, each life cycle stage includes all the aspects related to its inputs and outputs. For example, regarding waste quantification, each stage includes the production, transportation, treatment and disposal of the waste generated at the considered stage (discarded products, materials, etc.).

2.2.2. Stages to be included

The environmental information included in the PEP shall cover all the stages of the life cycle ("cradle to grave"). Therefore, the life cycle shall be divided into the following stages:

- Manufacturing stage: from the extraction of natural resources to product and packaging manufacturing and their delivery to the manufacturer's last logistics platform,
- Distribution stage: transportation from the last manufacturer's logistics platform to the arrival of the product at the place of use,
- Installation stage: installation of the product at the place of use,
- Use stage: use of the product and maintenance necessary to ensure the ability for use,
- End-of-life stage: removal, dismantle and transportation of the end-of-life product to a treatment centre or landfill site, and the end-of-life treatment.

The details of the processes allocated to each stage shall comply with sections 2.2.3 to 2.2.7. The diagram of the scope of the LCA is given in Appendix C.

2.2.3. Manufacturing stage

The inputs and outputs related to the following aspects shall be included in the manufacturing stage:

1. Production of the materials and components making up the reference product and assembly:
   - Production (extraction, treatment, transformation, etc.) and transportation of raw materials necessary to manufacture the components, including the flows associated with the waste and discarded materials generated by the manufacturing processes up to their end-of-waste status or disposal of final residues

- Industrial transforming and manufacturing processes of the various parts, components, and products
- Transportation of materials, components and subassemblies from the supplier's production site to the assembly site(s) and/or packaging site(s).

2. Production (extraction, treatment, transformation, etc.) of packaging raw materials and transportation of the packaging from its manufacturing site to the product packaging site. Packaging shall include the reference product packaging and the product manuals and labels, where applicable.
3. Industrial processes used to assemble the reference product and packaging components.
4. Transportation of the packaged product from the packaging site to the manufacturer's last logistics platform.

2.2.4. Distribution stage

The inputs and outputs associated with the following aspects shall be included in the distribution stage:

1. Transportation of the product in its packaging from the manufacturer's last logistics platform to the distributor and from the distributor to the installation place.
2. Where appropriate, production, procurement and transportation of reconditioning packaging materials:
   - Production (extraction, treatment, transformation, etc.) of raw materials and procurement of the reconditioning packaging,
   - Transportation of the reconditioning packaging from the point of reconditioning to the place of use.
3. Where appropriate, end-of-life management of the product packaging materials leaving the last logistic platform up to their end-of-waste status or disposal of the final residues.

2.2.5. Installation stage

The processes, components and energy included in the installation stage shall be described and justified in the LCA report and described in the PEP. In particular, the installation stage shall include the flows (energy consumption, emissions, etc.) related to the installation process.

The inputs and outputs associated with the following aspects shall be included in the installation stage:

1. For all products generating waste when installed: production and transport of such waste.
2. Manufacturing, packaging and procurement of materials and components not supplied with the reference product but required for its installation.
3. Installation processes.
4. Management of the waste generated at the installation place (collection and treatment up to its end-of-waste status, or disposal of the final residues):
   - Packaging,
   - Discarded installation materials,
   - Waste associated with the installation processes.

2.2.6. Use stage

The use stage of the reference product shall consider product operation under normal conditions of use[4].

The inputs and outputs associated with the following aspects shall be included in the use stage:

1. Energy consumption and others flows (emissions, water, etc.) of the product during its use over the RLT.
2. Production, distribution, installation and end-of-life of elements required to operate, service and maintain the reference product over the RLT.

Elements specified by the manufacturer and not supplied with the product shall be included (preventive and regulatory maintenance, wear parts, etc.).

2.2.7. End-of-life stage

The inputs and outputs associated with the following aspects shall be included in the end-of-life stage:

1. Required transportation to collect the end-of-life product and transport it from the installation site to the final treatment site.
2. Treatment processes (landfilling or incineration without waste-to-energy recovery), including depollution treatment of items (for example items covered by WEEE Directive 2012/19/EU) to be sent to special end-of-life product treatment centers, up to final treatment.

System expansion is not allowed at end-of-life stage (i.e. environmental benefits from energy recovering and recycling are excluded).

NOTE : The end-of-life of the product under study therefore corresponds to a disposal and/or storage process in the case of waste recovery.

2.2.8. Exclusions from system boundaries

All assessable input and output flows within the scope of the analysis shall be included.

However, the following flows are conventionally excluded from the analysis, due to the difficulty in allocating them to a particular reference flow:

- Lighting, heating, sanitary facilities and infrastructure cleaning[5] ,
- Employee transport,
- Manufacture and maintenance of the manufacturing facility and machines if they are not proportional to the reference flow,
- Construction and maintenance of the infrastructure[3] if they are not proportional to the reference flow,

[4] Technical requirements are satisfied by the product design regarding the intended application
[5] Manufacturing unit, logistics platform, transformation plant, administrative building, etc.

- Transport systems and infrastructures[3] if they are not proportional to the reference flow,
- Administrative, management and R&D department flows,
- Marketing activity related to the product.;
- Staff catering facilities,
- The packaging of raw material or the packaging of components used to manufacture the product.

The following processes are also excluded, because the professionals in the sector have recognized their limited impact:

- Clipping,
- Screwing,
- Parts fitting.

If any flow, process or element is not proportional to the reference flow, its impact is not allocated to the reference flow in the case it is negligible compared to the product (scale of the production series).

Additional exclusions, different from cut-off criteria may be defined in the PSR and provided that they are justified, as in the case of non-quantifiable flows.

2.3. Cut-off criteria

As mentioned into paragraph 2.2.8 all assessable inputs and outputs within the scope of the analysis shall be included:

- Either by collecting primary data that may be used to trace back to the elementary flows, when such data are available,
- Or, with secondary data from Life Cycle Inventory datasets (LCI datasets) or documented scientific models.

The following cut-off criteria shall be applied by default for each stage:

- The mass of intermediate flows not taken into account shall be less than or equal to 5% of the mass of the elements of the reference product corresponding to the functional unit.
- The energy flows not taken into account shall be less than or equal to 5 % of the total use of primary energy during the life cycle of the reference product corresponding to the functional unit.

If necessary, PSR should define more conservative cut-off criteria.

The list of all known intermediate flows not taken into account in the LCA, due to lack of LCI data shall be described in the LCA report.

2.4. Rules for allocation between co-products

In production systems with co-products, allocation rules for distributing the inputs and outputs to each of the products shall be defined and described in the LCA report (see paragraph 3 for LCA report content).

Where allocation cannot be avoided, the allocation procedures shall follow the requirements provided in paragraph 4.3.4 of ISO 14044.

To partition the consumption of energy, materials and water and the emissions to air, water and soil, as well as waste, a relevant allocation rule (physical, monetary, etc.) that best describes the functioning of the systems shall be applied.

Examples of the physical parameter used to allocate input and output flows are the mass, area or unit quantity produced, as appropriate to the production system (production of materials and parts, product assembly).

Allocation to the various co-products shall be proportional to the total value of the parameter for the production system under consideration.

2.5. Development of scenarios (default scenarios)

2.5.1. General

The scenarios to be used for the different life cycle stages are described in the PSR for a product category.

If no PSR is available for a given product category, or if the PSR does not provide information on a specific life cycle stage, the scenarios described in the following sections shall be used, and shall be documented in the LCA report. They also shall be mentioned in the PEP.

Besides, the reference scenario shall be mentioned in the PEP where PSR requires it.

2.5.2. Electricity consumption scenario

For all the life cycle stages except use phase, electricity consumption should be representative of the geographical area of the stage.

Regarding use phase, electricity consumption shall be representative of the geographical area of the use stage.

Life cycle inventory datasets provided in the ELCD database shall be used when available and representative of the geographic area. If no ELCD data are available, the source and model of the data shall be specified in the LCA report.

2.5.3. Transport scenarios

Transport-specific data should be taken into account for transportation stages (kilometres covered, types of transport). Data shall be justified and documented in the LCA report.

If no specific data are available, the following generic data shall be taken into consideration for all the stages, from manufacturing to end-of-life:

- International transport: 19,000 km by boat plus 1,000 km by lorry
- Intracontinental transport: 3,500 km by lorry
- Local transport: 1,000 km by lorry.

The LCI datasets in the ELCD database should be used for these scenarios:

- Lorry: the latest available version of the "Articulated lorry transport" dataset Euro 0, 1, 2, 3, 4 mix; 40 t total weight, 27 t max payload" dataset for "RER" location and non-parameterised;
- Ship: The latest available version of the "Ocean-going container ship; technology mix; 27.500 dwt pay load capacity" dataset for "RER" location and non-parameterised.

Any special means of transport necessary shall be taken into consideration.

2.5.4. Reference product use scenarios

The scenario definition shall consider the following where existing:

- Regulations applicable to product categories (e.g. execution measures adopted under ERP directives[6], etc.)
- Standards or harmonised standards
- Recommendations from manufacturers or manufacturers' organisations
- Use agreements established by consensus in sector-specific working groups.

The use scenario applied shall define at least:

- The reference life time (RLT)
- The load factor, activity factor
- Key use assumptions (for example: % use rate during the RLT).

The aforementioned criteria shall enable the consumed and/or dissipated energy and others flows (emissions, water, etc.) to be measured, according to the product category.

The rules defined by the PSR shall be applied. If the PSR defined a RLT, the manufacturer shall apply it.

The operating, servicing and maintenance conditions, as specified by the manufacturer shall include:

- The maintenance operation frequency where applicable,
- The parts, products and solvents used to maintain / service the reference product: batteries, light sources and any substance covered by a Safety Data Sheet,
- The consumables required for operation: ink, etc.

[6] Directive 2009/125/EC of the European Parliament and the Council of 21st October 2009 establishing a framework for the setting of ecodesign requirements for energy related products

If products are not covered by product-specific rules (PSR), the use scenarios shall be justified in the LCA report and the PEP shall mention at least:

- The reference life time (RLT)
- The load factor, activity factor
- Key use assumptions (for example: % use rate during the RLT).

2.5.5. Maintenance scenarios

For products not covered by a PSR, when legislation requires maintenance visits, the specific visit frequency mentioned in the legislation shall be applied. Then a transportation distance of 100 km for 1 person should be taken into account, using the respective ELCD LCI dataset when available.

Other distance data used for transport shall be described and justified in the LCA report.

2.5.6. End-of-life treatment scenarios

The following treatment scenarios shall be considered for all elements during the life cycle and documented in the LCA report:

1. Product/material disposal processes (incineration without waste-to-energy recovery, landfill)

   If the product disposal treatment is known and/or the data are available, the impacts related to these processes shall be taken into account. The types of treatment used shall be described and documented in the LCA report.

   If distance data to the disposal site are not known, it shall be considered by default the transport by lorry of the considered product aver 1,000 km.

2. Product/material recovery (reuse, recycling or incineration with waste-to-energy recovery).

   In this case, the end-of-life treatment does not lead to waste disposal. The stage ends in the storage of the materials, which obtain the status of end-of waste. Environmental benefits and loads relating to secondary material, secondary fuel or recovered energy going out the product system shall not be included.

   Processes ending in waste storage shall be included in the scope of the analysis of the product that generates the waste.

   Processes enabling stored resources to be used shall be included in the scope of the study of the product that uses the resources.

   If distance data to the disposal site are not known, it shall be considered by default the transport by lorry of the considered product aver 1,000 km.

The system boundaries (and in particular the location of the stored materials) shall be clearly explained and documented in the LCA report.

If the treatment is unknown or the data are not available, it shall be considered by default the transport by lorry of the end-of-life product over 1,000 km and the disposal in landfill site by identified waste constituting material family. The following ELCD LCI dataset shall be used:

- Ferrous metals - Data set: Landfill of ferro metals (03.00.000) (source: Landfill of ferro metals; landfill including leachate treatment and without collection, transport and pre-treatment; at landfill site),
- Plastics - Data set: Landfill of plastic waste (03.00.000) – (source: Landfill of plastic waste; landfill including landfill gas utilisation and leachate treatment and without collection, transport and pre-treatment; at landfill site),
- Inert waste - Data set: Landfill of glass/inert waste (03.00.000) – (source : Landfill of glass/inert waste ;landfill including leachate treatment and without collection, transport and pre-treatment ;at landfill site).

NOTE : The constituent material of an electronic circuit board is considered to belong to the plastics family, which is the least beneficial case.

2.6. Rule(s) for extrapolation to a homogeneous environmental family

The PEP may cover products other than the reference product.

These products shall be mentioned in the PEP and in the LCA report, provided that they belong to the same homogeneous environmental family as the reference product. To belong to a homogeneous environmental family, the group of products shall have the following characteristics:

- Same main functionality
- Same product standards
- Similar manufacturing technology: same type of materials and manufacturing processes.

If the environmental data, material balance or environmental impacts differ from those of the reference product, extrapolation rule(s) allowing the data to be estimated at every stage of the life cycle shall be used.

Extrapolation rules may be already set in the specific rules (PSR). In this case they can be directly applied. These rules are set on the basis of different products LCA and justified and documented in the PSR. Besides, they are verified during the third party review of the PSR.

If no rules are set in the PSR, the following stages shall be followed to define extrapolation rule(s):

- Perform the LCA of representative products of the homogeneous family,
- Identify and quantify the products parameters that vary between the different products of the homogeneous environmental family (i.e. dimensions, weight of parts, materials, energy consumption,…) and run a sensitivity analysis to identify influential parameters and define an extrapolation rule
- The extrapolation rule(s) shall be indicated into PEP.

This process shall be documented in the LCA report.

2.7. Rules applying to joint environmental declarations

A joint environmental declaration shall meet the following conditions. It shall:

- Apply to a "typical product",
- Be based on the homogeneity of the parameters that significantly influence the value of each of the environmental indicators,
- Include a framework of validity that incorporates the following information:
  - The identification of the influential parameters, while specifying whether they are sourced from secondary or primary data
  - The intervals of validity of these parameters.

This information shall be justified and documented in the LCA report.

Appendix B, which includes an example of a definition of a framework of validity, should be used.

2.8. Units

In general, international system units shall be used. However, the following units can be used:

- For masses: grams (g)
- For energy: megajoules (MJ) or kilowatthours (kWh: 1 kWh =3.6 MJ)
- For radioactive emissions: kilobecquerels (kBq).

2.9. Primary data collection requirements

All assessable input and output flows within the scope of the analysis shall be included.

For each unit process within the system boundaries, inputs and outputs related to the reference flow shall be collected including:

- Consumption of materials, energy, water,
- Emissions to air, water, soil,
- Waste from the processes analysed. Waste shall be classified and the classification method documented in the LCA report.

In addition to the requirements above, the following recommendations shall be applied:

- The collected flows shall be averaged over a sufficiently long period, preferably over a year, to even out any seasonal peaks,
- The collected data shall be representative of a current scenario in terms of geographic coverage and technologic coverage. When data are collected from several sites, the data shall be collected from representative sites. The method used to aggregate the

multi-site data (i.e. measurements taken on each site) and the rules applying to the creation of data sources shall be documented in the LCA report,

- The method of allocation to the reference flow shall be documented in the LCA report,
- Any deviations or missing data (data not available on all sites) shall be clearly identified and the rules for processing this missing data documented in the LCA report,

There is no need to collect information on noise or odour pollution and on the use of space due to the difficulty to characterize them. Information noise or odour pollution can nevertheless be mentioned in the additional information chapter.

2.10. Secondary data requirements

When primary data are not available, secondary data should be used for the processes included in the system boundaries. Secondary data shall be identified and consistent with the scope of the study in terms of time-related, geographic and technologic coverage.

In order to evaluate secondary data coverage and consistency with the scope of the study, and for the purpose of transparency and traceability, secondary data for which time-related, geographic and technologic coverage is available shall be used and listed in the LCA report. If the coverage is not available, qualitative assessments shall be explained in the LCA report. Also, the rules used for adapting secondary data to be consistent with the scope of the study shall always be clearly described in the LCA report.

In addition to the Program requirements mentioned above, secondary data should be selected from one of the sources below, in descending order of priority:

1. LCI datasets that have been checked by independent experts attesting to their conformity with this PCR
2. LCI datasets that have been checked by the PEP developer attesting to their conformity with the PCR
3. LCI datasets based on LCA studies compliant with ISO 14040 and 14044 standards or any other reference document referring to these standards and independently verified.
4. LCI datasets that have been pre-checked by the data supplier attesting to their conformity with this PCR
5. LCI datasets with no proof of verification. In this case, the LCA report shall justify the selection of this dataset.

NOTE: For the five criteria above, the most up-to-date LCI datasets should be used, considering the same coverage (representativeness).

For the scenarios by default, the most up-to-date LCI datasets from ELCD database should be used when available.

2.11. Data quality evaluation

For all the unit processes included in the system boundaries, the quality of primary and secondary data shall be assessed in the LCA report. According to ISO 14044 standard, the data quality assessment shall address the following:

- Time-related coverage,
- Geographical coverage,
- Technology coverage,
- Precision,
- Completeness,
- Representativeness,
- Consistency.

2.12. Environmental impact calculation

The selection of indicators by the program is based on the level of international recognition and takes into consideration the specific nature of the production of electrical, electronic and HVAC-R equipment and the requirements of other industry sectors, such as the European construction industry.

The indicators selected by the program are classified into two categories:

- a common base of mandatory indicators,
- optional indicators that companies are free to choose and declare.

The detailed definitions of the indicators and the characterization factors specified in the tables in Appendix A shall be used.

The impact results shall correspond to the sum of the characterized flows.

2.12.1. Common base of mandatory indicators

The parameters and units to be selected are:

- Environmental impact indicators
  - Global warming expressed in kg CO_2 eq.
  - Ozone depletion expressed in kg CFC-11 eq.
  - Acidification of soils and water expressed in kg SO_2 eq.
  - Water eutrophication expressed in kg $(PO_4)^{3-}$ eq.
  - Photochemical ozone formation expressed in kg C_2H_4 eq.
  - Depletion of abiotic resources - elements, expressed in kg Sb eq.
- Inventory flows indicator:
  - Total use of primary energy during the life cycle expressed in MJ

- Net use of fresh water expressed in m^3.

2.12.2. Optional indicators

The parameters and units to be selected are:

- Environmental impact indicators:
  - Depletion of abiotic resources – fossil fuels, expressed in MJ
  - Water pollution expressed in m^3
  - Air pollution expressed in m^3
- Inventory flows indicator:
  - Indicators describing the use of primary energy resources:
    - ✓ Use of renewable primary energy, excluding renewable primary energy resources used as raw materials, expressed in MJ
    - ✓ Use of renewable primary energy resources used as raw materials, expressed in MJ
    - ✓ Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials), expressed in MJ
    - ✓ Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials, expressed in MJ
    - ✓ Use of non-renewable primary energy resources used as raw materials, expressed in MJ
    - ✓ Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials), expressed in MJ
  - Indicators describing the use of secondary materials and energy resources (e.g. waste combustion):
    - ✓ Use of secondary materials expressed in kg
    - ✓ Use of renewable secondary fuels expressed in MJ
    - ✓ Use of non-renewable secondary fuels expressed in MJ
  - Indicators describing categories of waste:
    - ✓ Hazardous waste disposed of, expressed in kg
    - ✓ Non-hazardous waste disposed of, expressed in kg
    - ✓ Radioactive waste disposed of, expressed in kg
  - Indicators describing output flows:
    - ✓ Components for reuse, expressed in kg
    - ✓ Materials for recycling, expressed in kg
    - ✓ Materials for energy recovery, expressed in kg
    - ✓ Exported energy, expressed in MJ by energy vector.

3. LCA report

3.1. General

A LCA report shall be made available to the authorised verifier to demonstrate that the analysis complies with the rules in this document.

It shall contain the information described in sections 3.2 to 3.7 regarding:

- General information,
- Reference flow and the functional unit,
- Life cycle inventory,
- List of elementary flows,
- Environmental impacts,
- Additional environmental information.

NOTE : The company is free to choose formal or graphical aspects.

The content of the LCA report is described in last updated version of the document entitled "LCA report content" (AP0012) available from the PEP ecopassport® program website.

3.2. General information

The LCA report shall indicate:

- The date of the report,
- The name of the persons/agents who drew up the report,
- The version of the PCR applied,
- The version of the PSR applied, where appropriate,
- The identification of the LCA report,
- The period of validity.

3.3. Reference flow and functional unit

The LCA report shall indicate:

- The reference flow as defined in paragraph 2.1 ,
- The product category (reference to the applicable PSR),
- The description and justification of the functional unit (e.g.: standards fulfilled by the reference product, test reports),
- The reference life time and its justification when no PSR is available,

- Where applicable:
  - The products from the same homogeneous environmental family as the reference product
  - The extrapolation rule(s) used to estimate the environmental impacts of the products from the reference product, which shall be described, justified and documented
  - The list of entitled entities for joint environmental declaration.

3.4. Life cycle inventory

3.4.1. Data sources

The LCA report shall indicate the source of the LCI datasets used and the data used for the calculation (e.g.: Database editor, database version, and data list).

For specific LCI datasets used for the LCA, attach the specific LCA reports or the information necessary to access them.

For all life cycle stages, the list of intermediate flows that have not been considered in the analysis due to the lack of LCI dataset shall be reported in the LCA report.

The data quality assessment shall be mentioned into the LCA report.

3.4.2. Life cycle stages

3.4.2.1. Manufacturing stage

The LCA report shall:

- Clearly identify and quantify (e.g. mass, etc.) each material, component and process used to produce the reference flow, as well as the corresponding dataset used
- Identify and justify any approximations or exclusions of materials, components or processes.
- Indicate the justification for the mass and the energy consumption to verify the cut-off criteria.
- Identify the transport data for the raw materials to the manufacturing site and the reference flow to the manufacturer's final logistics platform, as well as the corresponding datasets used.
- Indicate clearly, describe and justify if any transport scenarios other than those indicated in section 2.5.3 in this document are used.

Finally, a flowchart representing manufacturing stage may be added.

3.4.2.2. Distribution stage

The LCA report shall indicate the transport scenarios from the manufacturer's platform to the site of use and the corresponding dataset used. If any transport scenarios other than those described in section 2.5.3 in this document are used, it shall be clearly indicated, described and justified (i.e. internal statistics on transport).

3.4.2.3. Installation stage

The LCA report shall:

- Clearly identify and quantify (e.g. mass, volume, number, etc.) each component, process and type of energy required to install the product and the corresponding datasets used.
- Identify and justify any approximations or exclusions of components, processes or energy flows.

3.4.2.4. Use stage

The LCA report shall:

- Clearly identify any complex product operating modes.
- For each product operating mode, indicate the hypotheses considered (use rate, energy consumption, path-through current, etc.).
- If the product is covered by a standard or regulation that defines an energy consumption measurement method, clearly identify it (e.g. ErP performance measurement, thermal regulations, etc.).
- Indicate the selected energy model and the corresponding dataset used.
- Clearly identify and quantify (e.g. mass, volume, number, etc.) the elements required to operate, service and maintain the product and the corresponding datasets used.
- Identify and justify any approximations or exclusions.

If no PSR exists on the product category, the use scenario shall be based on existing standards or regulations, or, by default, on experimental measurements (the measurement protocol and results shall be also included). This shall be indicated in the LCA report.

3.4.2.5. End-of-life stage

The LCA report shall:

- Indicate, describe and justify the transport scenarios and the corresponding datasets used.
- Describe the product end-of-life scenario and the corresponding datasets used.
- Identify and justify any approximations or exclusions of any stage of the end-of-life scenario.

3.5. List of elementary flows

The LCA report shall include the list and units of elementary flows or the information required to access it (e.g.: how to access it in an LCA tool).

The list of elementary flows shall be accessible during the entire period of PEP validity.

3.6. Environmental indicators

The LCA report shall indicate:

- The environmental indicators calculated, expressed as a numerical value in the corresponding unit with three significant figures (and in addition option as a percentage) for each of the aforementioned life cycle stages and for the total life cycle.
- Where appropriate, the name and version of the software used if an LCA software application is used to calculate the impacts.

3.7. Additional environmental information

The LCA report shall justify all quantitative or qualitative information included in the PEP according to the paragraph 4.3.

4. Drawing up the Product Environmental Profile

The PEP shall contain the information described in the following sections regarding:

- General information
- Constituent materials
- Additional environmental information
- Environmental impacts

NOTE: The Company is free to choose formal or graphical aspects.

4.1. General information

The editorial rules to be applied are in document AP0008 – Editorial rules - available from the PEP ecopassport® program website. This document details the limitations to the use of the logo.

4.1.1. Name of the document

The term "Product Environmental Profile" and the "PEP ecopassport®" logo (below) shall be included in the environmental declaration.

The logo is available on demand on PEP ecopassport® website.

4.1.2. Information about the PEP ecopassport® program

The information shall include:

- The registration number of the PEP in the program,
- The name of the program, the program operator address, and if relevant , logo and website,
- The date of publication and the validity period,
- The identification of the applicable "Product Category Definition Rules" (PCR) document and its version,
- Where applicable, the identification of the "Product-Specific Rules" (PSR) document used and its version,
- The text: "Compliant with ISO 14025: 2010 Type III environmental declarations",
- The text specified in ISO 14025: "The PCR review was conducted by an expert panel chaired by <name and organisation of the chair of the review panel>" ,
- The text: "The content of this PEP cannot be compared with content based on another program",
- The verification text specified in ISO 14025: "Independent verification of the declaration and data, according to ISO 14025:2010: ☐internal ☐external",
- The verifier's accreditation number.

NOTE : A part of this information is described in the checklist title block presented in the document AP0008 – Editorial rules - available from the PEP ecopassport® program website.

4.1.3. Company information

The company information shall include at least:

- The company details (name, web site),
- The details of a legal contact in the company (e.g. create a specific email address).

4.1.4. Reference product and methodology

The PEP shall indicate:

- The PEP reference product ,
- An illustration of the reference product where appropriate,
- Information that unambiguously identifies the reference product: trade reference, etc.,
- The functional unit used to draw up the PEP ,
- Where appropriate:
  - The product category to which the product(s) belong,
  - The list of eligible entities and the list of the products studied in case of joint environmental declaration.

4.1.5. Homogeneous environmental families

The PEP may cover products other than the reference product.

In this case, the extrapolation rules established to estimate the data related to a product from the reference product and the way to use them shall be indicated in the PEP.

For example, the environmental impact extrapolation rule concerning the indicator for the depletion of the natural resources of the planet may be stated as "The impacts of raw material depletion can be extrapolated to other products in the homogeneous environmental family by applying a rule of proportionality to the mass of the reference product".

4.2. Constituent materials

- The total mass of the reference product, packaging and additional elements supplied with the reference product by the manufacturer shall be indicated.
- For the following categories, indicate their distribution in percentage of the total mass of the reference product, packaging and elements supplied with the reference product:
  - Plastics,
  - Metals,
  - Others.
- Materials can be also further listed by material groups or by base materials as defined in IEC 62474:
  - Example of a material groups: copper and alloys, thermoplastics,
  - Example of base materials: copper, zinc, lead, polycarbonate, talc, dye.
- Beyond appearing in 15 material groups or basic materials, they shall also be listed under "Miscellaneous".
- Distribution data for materials shall be expressed as a % of the reference product mass with 1 digit after the decimal point and ranked in descending order of mass if it is presented in the form of a table.

- The materials shall cover the entire reference product, packaging and elements supplied with the reference product.
- The value of substances and materials with a mass lower than 0.1 % shall be given as "<0.1%".
- Plastics can be identified in conformity with the relevant current standards.
- Some components (e.g.: electronic circuit boards, cells and batteries, fluorescent lamps) can be listed with their mass in the material balance without a description of the constituent materials, except for hazardous substances such as those listed in the following sections.

4.3. Additional environmental information

4.3.1. General

Certain relevant aspects should be specified in the PEP according to ISO 14025 standard and the general instructions of the PEP ecopassport® program following:

- Additional environmental information shall be specific, accurate and not misleading. They shall be based on information that is substantiated and verified, in accordance with the requirements of ISO 14020 and ISO 14021, clause 5.
- Additional environmental information shall only be related to environmental issues. It may include data on product performance, if environmentally significant. Information and instructions on product safety unrelated to the environmental performance of the product shall not be part of a Type III environmental declaration.
- Although the additional information cannot generally be related to a functional unit, it shall be provided for the same product as the product to which the environmental part of the declaration applies.

All additional environmental information shall be justified and documented in the LCA report and readily available on request and verifiable if it is disclosed:

- Where relevant, references shall be made to recognized measurement methods defined in PSR or to the standards in force.
- By default, measurement methods used to justify the additional environmental information shall rely on test report documented in LCA report.

4.3.2. Manufacturing

Actions to reduce the environmental impact of manufacturing activities such as any environmental management systems or a regulatory monitoring device can be mentioned, with a statement on where an interested party may find details of the system.

The additional environmental information may include information on absence or level of presence of a material that is considered of environmental significance in certain areas [see ISO

14020 and ISO 14021, 5.7 (r)]. It shall not refer to the absence of substances or features that are not or have never been associated with the product category.

The hazardous substances specified in the various regulations (REACH, RoHS, etc.) or standards (IEC 62474, etc.) in force in the countries concerned and used in the composition of the reference flow can be mentioned as additional information.

For example, the following hazardous substances specified in the RoHS Directive can be declared when present in the homogeneous materials of the product:

- Lead,
- Mercury,
- Cadmium,
- Hexavalent chromium,
- Polybrominated biphenyl (PBB) ,
- Polybrominated diphenyl ether (PBDE).

If the quantity of a hazardous substance is indicated, it shall be expressed as specified by the regulations in force.

4.3.3. Distribution

Actions to reduce the environmental impact of the distribution stage such as the establishment of specific logistic processes can be mentioned.

4.3.4. Installation

Actions to reduce the environmental impact of the installation process can be mentioned.

4.3.5. Use

Actions to reduce product pollution and its impact on the environment according to the characteristics of the reference product and consistent with the product use scenarios can be mentioned.

The following aspects can be provided, when relevant:

- Instructions and limits for efficient use,
- Noise level, when considered by the applicable standards,
- Electromagnetic emissions, when considered by the applicable standards.

A product may reduce, through its main function, the environmental impact of a system with which it interacts or it monitors, for instance: Thermostat, variable speed drive, presence detector, boiler controller…

In this case, claimed environmental impact reduction may be mentioned in the use phase section in the PEP and shall be clearly calculated, justified and documented in the LCA report.

4.3.6. End of life

Actions to reduce the end-of-life impact of the reference flow on the environment should be mentioned, such as participation in recycling or recovery programs, provided that details of these programs are readily available to the purchaser or user and contact information is provided.

For products submitted to end-of-life treatment regulations, the presence and mass of any components or subassemblies that have to be sent to specific treatment centres should be mentioned (e.g. Directive 2012/19/EU on Waste Electrical and Electronic Equipment).

The quality of design of the product with respect to end of life can be mentioned. In this case, it can be measured with a recyclability rate indicator. The recyclability rate represents the recycling potential of the product in terms of its design: technology and input materials. The recycling method and potential values shall be compatible with the relevant standards. Document IEC/TR 62635 should be used for electrical and electronic equipment. Other methods shall be mentioned and documented in the PSR and PEP and justified in the LCA report.

4.4. Environmental impacts

The PEP shall specify:

- The life cycle stages taken into account in the environmental impact analysis,
- The table of environmental impacts in numerical values, expressed in the corresponding units with three significant figures (and in option as a percentage) for each stage of the life cycle, and the total for each indicator of the complete life cycle assessment,
- If the stages of the life cycle are calculated according to different parameters, each column shall specify the applicable parameter mentioned in the functional unit.
- The name and version of the LCA software and database,
- The product category and the use scenario specifying:
  - The reference life time,
  - The description of the product use scenario,
- Where appropriate, the applicable product standards,
- For the installation phase, the installation elements taken into account,
- The product maintenance scenario and the consumables used during the reference life time of the product category,
- Information on the geographical and technological representativeness of the PEP,
- The energy model used to determine the impacts of the manufacturing, installation, use and end-of-life stages.

NOTE For a given indicator, a life cycle stage can be considered to be negligible if it represents less than 0.01% of the total life cycle of the reference flow. In this case, it shall be shown as 0 in the environmental impacts table for this stage and this indicator and "represents less than 0.01% of the total life cycle of the reference flow" shall be inserted under the table.*

5. PEP update rules

The development rules are specified in the general instructions of the PEP ecopassport® program. Specific rules can be defined in the PSR.

Appendices

Appendix A: Definitions, calculation methods and characterization factors of environmental impact categories

The following environmental indicators shall be provided. The sources are provided in Table.

NOTE The elements quoted in this Appendix are derived from EN 15804:2012+A1:2013 and CML-IA version 4.2, dated April 2013.

- Indicators describing environmental impacts as per table A.1:

Table A.1 — Environmental impact indicators

Indicator	Description	Unit
Global warming	Indicator of potential global warming caused by emissions to air contributing to the greenhouse effect	kg CO_2 eq.
Ozone depletion	Indicator of emissions to air that contribute to the destruction of the ozone layer	kg CFC-11 eq.
Acidification of soil and water	Indicator of the potential acidification of soils and water caused by the release of certain gases to the atmosphere	kg SO_2 eq.
Eutrophication	Indicator of the contribution to eutrophication of water by the enrichment of the aquatic ecosystem with nutritional elements, e.g. industrial or domestic effluents, agriculture, etc.	kg$(PO_4)^{3-}$ eq.
Photochemical ozone creation	Indicator of emissions of gases that affect the creation of photochemical ozone in the lower atmosphere (smog) due to the effect of the rays of the sun.	kg C_2H_4 eq.
Depletion of abiotic resources - elements	Indicator of the depletion of natural non-fossil resources	kg Sb eq.
Depletion of abiotic resources – fossil fuels	Indicator of the depletion of natural fossil resources	MJ (Lower Heating Value)
Water Pollution	Indicator of the quantity of water necessary to dilute the toxic elements poured into water in all the stages of the product life cycle.	m^3
Air pollution	Indicator of the quantity of air necessary to dilute the toxic elements emitted into the air in all the stages of the product life cycle.	m^3

NOTE The "Water pollution" and "Air pollution" indicators are derived from XP P01-064/CN, April 2014 and may be changed in order to refine their characterization and their application to other substances and, in particular, to mixes.

- indicators describing the use of resources as per table A.2:

Table A.2 — Resource use indicators

Indicator	Unit
Use of renewable primary energy, excluding renewable primary energy resources used as raw materials	MJ, Lower Heating Value
Use of renewable primary energy resources as raw materials	MJ, Lower Heating Value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, Lower Heating Value
Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials	MJ, Lower Heating Value
Use of non-renewable primary energy resources as raw materials	MJ, Lower Heating Value
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, Lower Heating Value
Total use of primary energy [Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)+ Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)]	MJ, Lower Heating Value
Use of secondary materials	kg
Use of renewable secondary fuels	MJ, Lower Heating Value
Use of non-renewable secondary fuels	MJ, Lower Heating Value
Net fresh water use	m^3
Note: To identify the share of input renewable / non-renewable energy used as an energy vector and not as a raw material, the "use of renewable / non-renewable primary energy, excluding renewable / non-renewable primary energy resources used as raw materials" indicator shall be taken into consideration and can be calculated as the difference between the total primary energy input and the input of energy resources used as raw materials.	

- indicators describing categories of waste as per table A.3:

Table A.3 — Waste category indicators

Indicator	Unit
Hazardous waste disposed	kg
Non-hazardous waste disposed	kg
Radioactive waste disposed	kg

NOTE Hazardous waste is a specific form of waste with a certain degree of toxicity that necessitates special treatment (as stipulated in Directive 91/689/EC and decision 2532 EC). Non-hazardous waste is non-toxic and similar to household waste. Non-hazardous waste is made up of inert waste (that does not decompose) and ordinary/household/similar household waste.

- Indicators describing output flows as per table A.4:

Table A.4 — Output flow indicators

Indicator	Unit
Components for reuse	kg
Materials for recycling	kg
Materials for energy recovery	kg
Exported energy	MJ by energy vector
Note 1: The "materials for energy recovery" indicator does not include materials intended for waste incineration. Waste incineration is a waste treatment method and is allocated within the boundaries of the system. The energy yield of waste incineration facilities is lower than that of power plants using secondary fuels. Materials for energy recovery are based on an energy yield of the power plant higher than or equal to 60%, or 65% for facilities built after 31 December 2008, in order to comply with the distinction made by the European Commission.	
Note 2: Exported energy refers to energy produced by the incineration of waste and by landfill sites.	

The factors shown in tables A.5 to A.13 below shall be used to characterize the indicators.

Additional factors can be used to improve the consistency between the life cycle inventory data with a more detailed flow list and the characterization factors available. The use of these factors shall be clearly documented.

Table A.5 — Characterization factor of the global warming indicator

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg CO_2 eq.
1,1,1-Trichloroethane	71-55-6	Halogenated non-aromatic	Air	kg	1.46 E+02
Carbon dioxide	124-38-9	Inorganic	Air	kg	1.0 E+00
CFC-11	75-69-4	Halogenated non-aromatic	Air	kg	4.75 E+03
CFC-113	76-13-1	Halogenated non-aromatic	Air	kg	6.13 E+03
CFC-114	76-14-2	Halogenated non-aromatic	Air	kg	1.0 E+04
CFC-115	76-15-3	Halogenated non-aromatic	Air	kg	7.37 E+03
CFC-12	75-71-8	Halogenated non-aromatic	Air	kg	1.09 E+04
CFC-13	75-72-9	Halogenated non-aromatic	Air	kg	1.44 E+04
Dichloromethane	75-09-2	Halogenated non-aromatic	Air	kg	8.70 E+00

Substance	CAS no	Group	Initial collection or emission compartment	Unit	Characterization factor kg CO_2 eq.
Dinitrogen oxide	10024-97-2	Inorganic	Air	kg	2.98 E+02
HALON-1211	353-59-3	Halogenated non-aromatic	Air	kg	1.89 E+03
HALON-1301	75-63-8	Halogenated non-aromatic	Air	kg	7.14 E+03
HALON-2402	25497-30-7	Halogenated non-aromatic	Air	kg	1.64 E+03
HCFC-123	306-83-2	Halogenated non-aromatic	Air	kg	7.70 E+01
HCFC-124	2837-89-0	Halogenated non-aromatic	Air	kg	6.09 E+02
HCFC-141b	1717-00-6	Halogenated non-aromatic	Air	kg	7.25 E+02
HCFC-142b	75-68-3	Halogenated non-aromatic	Air	kg	2.31 E+03
HCFC-22	75-45-6	Halogenated non-aromatic	Air	kg	1.81 E+03
HCFC-225ca	422-56-0	Halogenated non-aromatic	Air	kg	1.22 E+02
HCFC-225cb	507-55-1	Halogenated non-aromatic	Air	kg	5.95 E+02
HFC-125	354-33-6	Halogenated non-aromatic	Air	kg	3.50 E+03
HFC-134a	811-97-2	Halogenated non-aromatic	Air	kg	1.43 E+03
HFC-143a	420-46-2	Halogenated non-aromatic	Air	kg	4.47 E+03
HFC-152a	75-37-6	Halogenated non-aromatic	Air	kg	1.24 E+02
HFC-227ea	431-89-0	Halogenated non-aromatic	Air	kg	3.22 E+03

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg CO_2 eq.
HFC-23	75-46-7	Halogenated non-aromatic	Air	kg	1.48 E+04
HFC-236fa	690-39-1	Halogenated non-aromatic	Air	kg	9.81 E+03
HFC-32	75-10-5	Halogenated non-aromatic	Air	kg	6.75 E+02
HFC-43-10mee	138495-42-8	Halogenated non-aromatic	Air	kg	1.64 E+03
Methane	74-82-8	Non-aromatic (alkane)	Air	kg	2.50 E+01
Methyl chloride	74-87-3	Halogenated non-aromatic	Air	kg	1.30 E+01
Methyl bromide	74-83-9	Pesticide	Air	kg	5.00 E+00
Perfluorobutane	355-25-9	Halogenated non-aromatic	Air	kg	8.86 E+03
Perfluorocyclobutane	115-25-3	Halogenated non-aromatic	Air	kg	1.03 E+04
Perfluoroethane	76-16-4	Halogenated non-aromatic	Air	kg	1.22 E+04
Perfluorohexane	355-42-0	Halogenated non-aromatic	Air	kg	9.30 E+03
Perfluoromethane	75-73-0	Halogenated non-aromatic	Air	kg	7.39 E+03
Perfluoropropane	76-19-7	Halogenated non-aromatic	Air	kg	8.83 E+03
Sulphur hexafluoride	2551-62-4	Inorganic	Air	kg	2.28 E+04
Tetrachloromethane	56-23-5	Halogenated non-aromatic	Air	kg	1.40 E+03
HFC-245fa	460-73-1		Air	kg	1.03 E+03
HFE-125	3822-68-2		Air	kg	1.49 E+04
HFE-134	1691-17-4		Air	kg	6.32 E+03
HFE-143a	421-14-7		Air	kg	7.56 E+02
HCFE-235da2	HCFE235da2		Air	kg	3.50 E+02

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg CO_2 eq.
HFE-245cb2	HFE245cb2		Air	kg	7.08 E+02
HFE-245fa2	HFE245fa2		Air	kg	6.59 E+02
HFE-254cb2	HFE254cb2		Air	kg	3.59 E+02
HFE-347mcc3	HFE347mcc3		Air	kg	5.75 E+02
NF3	7783-54-2		Air	kg	1.72 E+04
HFE-356pcc3	HFE-356pcc3		Air	kg	1.10 E+02
PFC-4-1-12	594-91-2		Air	kg	9.16 E+03
PFC-9-1-18	60433-11-6		Air	kg	7.50 E+03
Trifluoromethyl sulphur pentafluoride	Trifluoromethyl sulphur pentafluoride		Air	kg	1.77 E+04
HFE-347pcf2	HFE-347pcf2		Air	kg	5.80 E+02
(HFE-7100)	(HFE-7100)		Air	kg	2.97 E+02
HFE-569sf2	HFE-569sf2		Air	kg	5.90 E+01
HFE-43-10pccc124 (H-Galden1040x)	HFE-43-10pccc124 (H-Galden1040x)		Air	kg	1.87 E+03
HFE-236ca12 (HG-10)	HFE-236ca12 (HG-10)		Air	kg	2.80 E+03
HFE-338pcc13 (HG-01)	HFE-338pcc13 (HG-01)		Air	kg	1.50 E+03
PFPMIE	PFPMIE		Air	kg	1.03 E+04
Note: To characterize a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the global warming indicator					

Table A.6 — Characterization factor of the ozone layer depletion indicator

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg CFC-11 eq.
1,1,1-Trichloroethane	71-55-6	Halogenated non-aromatic	Air	kg	1.20 E-01
CFC-11	75-69-4	Halogenated non-aromatic	Air	kg	1.00 E+00
CFC-113	76-13-1	Halogenated non-aromatic	Air	kg	1.00 E+00
CFC-114	76-14-2	Halogenated non-aromatic	Air	kg	9.40 E-01
CFC-115	76-15-3	Halogenated non-aromatic	Air	kg	4.40 E-01

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg CFC-11 eq.
CFC-12	75-71-8	Halogenated non-aromatic	Air	kg	1.00 E+00
HALON (HALON 2401)	124-72-1	Halogenated non-aromatic	Air	kg	2.50 E-01
HBFC-1201	1511-62-2	Halogenated non-aromatic	Air	kg	1.40 E+00
HALON-1202	75-61-6	Halogenated non-aromatic	Air	kg	1.30 E+00
HALON-1211	353-59-3	Halogenated non-aromatic	Air	kg	6.00 E+00
HALON-1301	75-63-8	Halogenated non-aromatic	Air	kg	1.20 E+01
HBFC-2311	151-67-7	Halogenated non-aromatic	Air	kg	1.40 E-01
HBFC-2401 (HALON)	124-72-1 (b)	Halogenated non-aromatic	Air	kg	2.50 E-01
HALON-2402	25497-30-7	Halogenated non-aromatic	Air	kg	6.00 E+00
HCFC-123	306-83-2	Halogenated non-aromatic	Air	kg	2.00 E-02
HCFC-124	2837-89-0	Halogenated non-aromatic	Air	kg	2.00 E-02
HCFC-141b	1717-00-6	Halogenated non-aromatic	Air	kg	1.20 E-01
HCFC-142b	75-68-3	Halogenated non-aromatic	Air	kg	7.00 E-02
HCFC-22	75-45-6	Halogenated non-aromatic	Air	kg	5.00 E-02
HCFC-225ca	422-56-0	Halogenated non-aromatic	Air	kg	2.00 E-02
HCFC-225cb	507-55-1	Halogenated non-aromatic	Air	kg	3.00 E-02
Methyl chloride	74-87-3	Halogenated non-aromatic	Air	kg	2.00 E-02
Methyl bromide	74-83-9	Pesticide	Air	kg	3.80 E-01
Tetrachloromethane	56-23-5	Halogenated non-aromatic	Air	kg	7.30 E-01
Note: To characterize a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the ozone layer depletion indicator					

Table A.7 — Characterization factor of the soil and water acidification indicator

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg SO_2 eq.
Ammonia	7664-41-7	Inorganic	Air	kg	1.60 E+00
Nitrogen dioxide	10102-44-0	Inorganic	Air	kg	5.00 E-01
Nitrogen monoxide	10102-43-9	Inorganic	Air	kg	7.60 E-01
Nitrogen oxides (as NO_2)	11104-93-1	Inorganic	Air	kg	5.00 E-01
Sulphur dioxide	7446-09-5	Inorganic	Air	kg	1.20 E+00
Sulphur trioxide	7446-11-9	Inorganic	Air	kg	9.60 E-1
Sulphuric acid	7664-93-9	Inorganic	Air	kg	7.84 E-1
Note: To characterise a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the acidification of soils and water indicator					

Table A.8 — Characterization factor of the eutrophication indicator

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg $(PO_4)^{3-}$ eq.
Ammonia	7664-41-7	Inorganic	Air	kg	3.50 E-01
Ammonium	14798-03-9	Inorganic	Air	kg	3.30 E-01
Dinitrogen oxide	10024-97-2	Inorganic	Air	kg	2.70 E-01
Nitrate	14797-55-8	Inorganic	Air	kg	1.00 E-01
Nitric acid	7697-37-2	Inorganic	Air	kg	1.00 E-01
Nitrogen	7727-37-9	Inorganic	Air	kg	4.20 E-01
Nitrogen dioxide	10102-44-0	Inorganic	Air	kg	1.30 E-01
Nitrogen monoxide	10102-43-9	Inorganic	Air	kg	2.00 E-01
Nitrogen oxides (as NO_2)	11104-93-1	Inorganic	Air	kg	1.30 E-01
Phosphate	14265-44-2	Inorganic	Air	kg	1.00 E+00
Phosphoric acid	7664-38-2	Inorganic	Air	kg	9.70 E-01
Phosphorus	7723-14-0	Inorganic	Air	kg	3.06 E+00
Ammonia	7664-41-7	Inorganic	Fresh water	kg	3.50 E-01

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg $(PO_4)3$- eq.
Ammonium	14798-03-9	Inorganic	Fresh water	kg	3.30 E-01
Chemical Oxygen Demand (COD)	COD		Fresh water	kg	2.20 E-02
Nitrate	14797-55-8	Inorganic	Fresh water	kg	1.00 E-01
Nitric acid	7697-37-2	Inorganic	Fresh water	kg	1.00 E-01
Nitrite	14797-65-0	Inorganic	Fresh water	kg	1.00 E-01
Nitrogen	7727-37-9	Inorganic	Fresh water	kg	4.20 E-01
Phosphate	14265-44-2	Inorganic	Fresh water	kg	1.00 E+00
Phosphoric acid	7664-38-2	Inorganic	Fresh water	kg	9.70 E-01
Phosphorus	7723-14-0	Inorganic	Fresh water	kg	3.06 E+00
Ammonia	7664-41-7	Inorganic	Sea water	kg	3.50 E-01
Ammonium	14798-03-9	Inorganic	Sea water	kg	3.30 E-01
Chemical Oxygen Demand (COD)	COD		Sea water	kg	2.20 E-02
Nitrate	14797-55-8	Inorganic	Sea water	kg	1.00 E-01
Nitric acid	7697-37-2	Inorganic	Sea water	kg	1.00 E-01
Nitrite	14797-65-0	Inorganic	Sea water	kg	1.00 E-01
Nitrogen	7727-37-9	Inorganic	Sea water	kg	4.20 E-01
Phosphate	14265-44-2	Inorganic	Sea water	kg	1.00 E+00
Phosphoric acid	7664-38-2	Inorganic	Sea water	kg	9.70 E-01
Phosphorus	7723-14-0	Inorganic	Sea water	kg	3.06 E+00
Ammonia	7664-41-7	Inorganic	Agricultural soil	kg	3.50 E-01
Ammonium	14798-03-9	Inorganic	Agricultural soil	kg	3.30 E-01
Nitrate	14797-55-8	Inorganic	Agricultural soil	kg	1.00 E-01
Nitric acid	7697-37-2	Inorganic	Agricultural soil	kg	1.00 E-01
Nitrogen	7727-37-9	Inorganic	Agricultural soil	kg	4.20 E-01
Phosphate	14265-44-2	Inorganic	Agricultural soil	kg	1.00 E+00
Phosphoric acid	7664-38-2	Inorganic	Agricultural soil	kg	9.70 E-01
Phosphorus	7723-14-0	Inorganic	Agricultural soil	kg	3.06 E+00
Ammonia	7664-41-7	Inorganic	Industrial soil	kg	3.50 E-01
Ammonium	14798-03-9	Inorganic	Industrial soil	kg	3.30 E-01
Nitrate	14797-55-8	Inorganic	Industrial soil	kg	1.00 E-01
Nitric acid	7697-37-2	Inorganic	Industrial soil	kg	1.00 E-01
Nitrogen	7727-37-9	Inorganic	Industrial soil	kg	4.20 E-01
Phosphate	14265-44-2	Inorganic	Industrial soil	kg	1.00 E+00
Phosphoric acid	7664-38-2	Inorganic	Industrial soil	kg	9.70 E-01
Phosphorus	7723-14-0	Inorganic	Industrial soil	kg	3.06 E+00
Phosphorus (V)oxide (P_2O_5)	1314-56-3	Inorganic	Air	kg	1.34 E+00
Phosphorus (V)oxide (P_2O_5)	1314-56-3	Inorganic	Fresh water	kg	1.34 E+00
Phosphorus (V)oxide (P_2O_5)	1314-56-3	Inorganic	Sea water	kg	1.34 E+00

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg $(PO_4)3$- eq.
Phosphorus (V)oxide (P_2O_5)	1314-56-3	Inorganic	Agricultural soil	kg	1.34 E+00
Phosphorus (V)oxide (P_2O_5)	1314-56-3	Inorganic	Industrial soil	kg	1.34 E+00
Note: To characterise a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the eutrophication indicator					

Table A.9 — Characterization factor of the photochemical ozone formation indicator

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg C_2H_4 eq.
1,1,1-Trichloroethane	71-55-6	Halogenated Non-aromatic	Air	kg	9.0 E-03
1,2,3-Trimethylbenzene	526-73-8	Halogenated aromatic	Air	kg	1.27 E+00
1,2,4-Trimethylbenzene	95-63-6	Halogenated aromatic	Air	kg	1.28 E+00
1,3,5-Trimethylbenzene	108-67-8	Aromatic	Air	kg	1.38 E+00
1,3-Butadiene	106-99-0	Non-aromatic (alkene)	Air	kg	8.51 E-01
1-Butanol	71-36-3	Non-aromatic (alcohol)	Air	kg	6.20 E-01
1-Butene	106-98-9	Non-aromatic (alkane)	Air	kg	1.08 E+00
1-Butoxypropanol	57018-52-7	Non-aromatic (alcohol)	Air	kg	4.63 E-01
1-Butyl acetate	123-86-4	Non-aromatic (ester)	Air	kg	2.69 E-01
1-Hexene	592-41-6	Non-aromatic (alkene)	Air	kg	8.74 E-01
1-Methoxy-2-propanol	107-98-2	Non-aromatic (alcohol)	Air	kg	3.55 E-01
1-Pentene	109-67-1	Non-aromatic (alkene)	Air	kg	9.77 E-01
1-Propanol	71-23-8	Non-aromatic (alcohol)	Air	kg	5.61 E-01
1-Propyl benzene	103-65-1	Aromatic	Air	kg	6.36 E-01
1-Propyl acetate	109-60-4	Non-aromatic (ester)	Air	kg	2.82 E-01
1-Undecane	1120-21-4	Non-aromatic (alkane)	Air	kg	3.84 E-01
2,2-Dimethylbutane	75-83-2	Non-aromatic (alkane)	Air	kg	2.41 E-01
2.3-Dimethylbutane	79-29-8	Non-aromatic (alkane)	Air	kg	5.41 E-01
2-Butanone	78-93-3	Non-aromatic (ketone)	Air	kg	3.73 E-01

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg C_2H_4 eq.
2-Butoxyethanol	111-76-2	Non-aromatic (alkane)	Air	kg	4.83 E-01
2-Ethoxyethanol	110-80-5	Non-aromatic (alcohol)	Air	kg	3.86 E-01
2-Methoxyethanol	109-86-4	Non-aromatic (alcohol)	Air	kg	3.07 E-01
2-Methyl-1-butene	563-46-2	Non-aromatic (alkene)	Air	kg	7.71 E-01
2-Methyl-2-butene	513-35-9	Non-aromatic (alkene)	Air	kg	8.42 E-01
2-Methylbutan-1-ol	137-32-6	Non-aromatic (alcohol)	Air	kg	4.89 E-01
2-Methylbutan-2-ol	75-85-4	Non-aromatic (alcohol)	Air	kg	2.28 E-01
2-Methylhexane	591-76-4	Non-aromatic (alkane)	Air	kg	4.11 E-01
2-Methylpentane	107-83-5	Non-aromatic (alkane)	Air	kg	4.20 E-01
3,5-Diethyltoluene	25550-13-4	Aromatic	Air	kg	1.30 E+00
3,5-Dimethylethylbenzene	934-74-7	Aromatic	Air	kg	1.32 E+00
3-Methyl-1-butene	563-45-1	Non-aromatic (alkene)	Air	kg	6.71 E-01
3-Methylbutan-1-ol	123-51-3	Non-aromatic (alcohol)	Air	kg	4.33 E-01
3-Methylbutan-2-ol	598-75-4	Non-aromatic (alcohol)	Air	kg	4.06 E-01
3-Methylhexane	589-34-4	Non-aromatic (alkane)	Air	kg	3.64 E-01
3-Methylpentane	96-14-0	Non-aromatic (alkane)	Air	kg	4.79 E-01
3-Pentanol	584-02-1	Non-aromatic (alcohol)	Air	kg	5.95 E-01
Acetaldehyde	75-07-0	Non-aromatic (alkane)	Air	kg	6.41 E-01
Acetic acid	64-19-7	Non-aromatic (carboxylic acid)	Air	kg	9.70 E-02
Acetone	67-64-1	Non-aromatic (ketone)	Air	kg	9.40 E-02
Acetylene	74-86-2	Non-aromatic (alkyne)	Air	kg	8.50 E-02
Benzaldehyde	100-52-7	Aromatic	Air	kg	-9.20 E-02
Benzene	71-43-2	Aromatic	Air	kg	2.18 E-01
Butane	106-97-8	Non-aromatic (alkane)	Air	kg	3.52 E-01
Butyraldehyde	123-72-8	Non-aromatic (aldehyde)	Air	kg	7.95 E-01
Carbon monoxide	630-08-0	Inorganic	Air	kg	2.70 E-02

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg C_2H_4 eq.
Cis-2-butene	590-18-1	Non-aromatic (alkene)	Air	kg	1.15 E+00
Cis-2-hexene	Cis-2-hexene	Non-aromatic (alkene)	Air	kg	1.07 E+00
Cis-2-pentene	627-20-3	Non-aromatic (alkene)	Air	kg	1.12 E+00
Cis-1,2-dichloroethylene	156-59-2	Halogenated Non-aromatic	Air	kg	4.47 E-01
Cyclohexane	110-82-7	Non-aromatic (alkane)	Air	kg	2.90 E-01
Cyclohexanol	108-93-0	Non-aromatic (alcohol)	Air	kg	5.18 E-01
Cyclohexanone	108-94-1	Non-aromatic (alkane)	Air	kg	2.99 E-01
Decane	124-18-5	Non-aromatic (alkane)	Air	kg	3.84 E-01
Diacetone-alcohol	123-42-2	Non-aromatic (alcohol)	Air	kg	3.07 E-01
Dichloromethane	75-09-2	Halogenated Non-aromatic	Air	kg	6.8 E-02
Diethyl Ether	60-29-7	Non-aromatic (ether)	Air	kg	4.45 E-01
Diethylketone	96-22-0	Non-aromatic (ketone)	Air	kg	4.14 E-01
Diisopropylether	108-20-3	Non-aromatic (ether)	Air	kg	3.98 E-01
Dimethoxy methane	109-87-5		Air	kg	1.64 E-01
Dimethyl carbonate	616-38-6		Air	kg	2.50 E-02
Dimethyl Ether	115-10-6	Non-aromatic (ether)	Air	kg	1.89 E-01
Dodecane	112-40-3	Non-aromatic (alkane)	Air	kg	3.57 E-01
Ethane	74-84-0	Non-aromatic (alkane)	Air	kg	1.23 E-01
Ethanol	64-17-5	Non-aromatic (alcohol)	Air	kg	3.99 E-01
Ethyl acetate	141-78-6	Non-aromatic (ester)	Air	kg	2.09 E-01
Ethyl trans-butyl ether	637-92-3	Non-aromatic (ether)	Air	kg	2.44 E-01
Ethylbenzene	100-41-4	Aromatic	Air	kg	7.3 E-01
Ethylene	74-85-1	Non-aromatic (alkene)	Air	kg	1.0 E+00
Ethylene Glycol	107-21-1	Non-aromatic (ester)	Air	kg	3.73 E-01
Formaldehyde	50-00-0	Non-aromatic (aldehyde)	Air	kg	5.19 E-01

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg C_2H_4 eq.
Formic acid	64-18-6	Non-aromatic (carboxylic acid)	Air	kg	3.20 E-02
Heptane	142-82-5	Non-aromatic (alkane)	Air	kg	4.94 E-01
Hexan-2-one	591-78-6	Non-aromatic (ketone)	Air	kg	5.72 E-01
Hexan-3-one	589-38-8	Non-aromatic (ketone)	Air	kg	5.99 E-01
Hexane	110-54-3	Non-aromatic (alkane)	Air	kg	4.82 E-01
Isobutane	75-28-5	Non-aromatic (alkane)	Air	kg	3.07 E-01
Isobutanol	78-83-1	Non-aromatic (alcohol)	Air	kg	3.60 E-01
Isobutene	115-11-7	Non-aromatic (alkene)	Air	kg	6.27 E-01
Isobutyraldehyde	78-84-2	Non-aromatic (aldehyde)	Air	kg	5.14 E-01
Isopentane	78-78-4	Non-aromatic (alkane)	Air	kg	4.05 E-01
Isoprene	78-79-5	Non-aromatic (alkene)	Air	kg	1.09 E+00
Isopropanol	67-63-0	Non-aromatic (alcohol)	Air	kg	1.88 E-01
Isopropyl acetate	108-21-4	Non-aromatic (ester)	Air	kg	2.11 E-01
Isopropylbenzene	98-82-8	Aromatic	Air	kg	5.00 E-01
Meta-ethyltoluene	620-14-4	Aromatic	Air	kg	1.02 E+00
Meta-xylene	108-38-3	Aromatic	Air	kg	1.11 E+00
Methane	74-82-8	Non-aromatic (alkane)	Air	kg	6.00 E-03
Methanol	67-56-1	Non-aromatic (alcohol)	Air	kg	1.40 E-01
Methyl acetate	79-20-9	Non-aromatic (ester)	Air	kg	5.90 E-02
Methyl chloride	74-87-3	Halogenated Non-aromatic	Air	kg	5.00 E-03
Methyl formate	107-31-3	Non-aromatic (ester)	Air	kg	2.70 E-02
Methyl Isobutyl Ketone	108-10-1	Non-aromatic (ketone)	Air	kg	4.90 E-01
Methyl oropyl Ketone	107-87-9	Non-aromatic (ketone)	Air	kg	5.48 E-01
Methyl-tert-butylether	1634-04-4	Non-aromatic (ether)	Air	kg	1.75 E-01
Methyl-tert-butylcetone	75-97-8	Non-aromatic (ketone)	Air	kg	3.23 E-01

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg C_2H_4 eq.
Methyl-Isopropylketone	563-80-4	Non-aromatic (ketone)	Air	kg	3.64 E-01
Neopentane	463-82-1	Non-aromatic (alkane)	Air	kg	1.73 E-01
Nitrogen dioxide	10102-44-0	Inorganic	Air	kg	2.8 E-02
Nitrogen monoxide	10102-43-9	Inorganic	Air	kg	-4.27 E-01
Nonane	111-84-2	Non-aromatic (alkane)	Air	kg	4.14 E-01
Octane	111-65-9	Non-aromatic (alkane)	Air	kg	4.53 E-01
Ortho-Ethyltoluene	611-14-3	Aromatic	Air	kg	8.98 E-01
Ortho-Xylene	95-47-6	Aromatic	Air	kg	1.05 E+00
Para-Ethyltoluene	622-96-8	Aromatic	Air	kg	9.06 E-01
Para-Xylene	106-42-3	Aromatic	Air	kg	1.01 E+00
Pentanaldehyde	Pentanaldehyde	Non-aromatic (aldehyde)	Air	kg	7.65 E-01
Pentane	109-66-0	Non-aromatic (alkane)	Air	kg	3.95 E-01
Propane	74-98-6	Non-aromatic (alkane)	Air	kg	1.76 E-01
Propanoic acid	79-09-4	Non-aromatic (carboxylic acid)	Air	kg	1.50 E-01
Propionaldehyde	123-38-6	Non-aromatic (aldehyde)	Air	kg	7.98 E-01
Propylene	115-07-1	Non-aromatic (alkene)	Air	kg	1.12 E+00
Propylene Glycol	57-55-6	Non-aromatic (ester)	Air	kg	4.57 E-01
Sec-butanol	78-92-2	Non-aromatic (alcohol)	Air	kg	4.00 E-01
Sec-butyl acetate	105-46-4	Non-aromatic (ester)	Air	kg	2.75 E-01
Styrene	100-42-5	Aromatic	Air	kg	1.42 E-01
Sulphur dioxide	7446-09-5	Inorganic	Air	kg	4.8 E-02
Tertiary-butanol	75-65-0	Non-aromatic (alcohol)	Air	kg	1.06 E-01
Tertiary-butyl acetate	540-88-5	Non-aromatic (ester)	Air	kg	5.30 E-02
Tetrachloroethylene	127-18-4	Halogenated Non-aromatic	Air	kg	2.9 E-02
Toluene	108-88-3	Aromatic	Air	kg	6.37 E-01
Trans-2-Butene	624-64-6	Non-aromatic (alkene)	Air	kg	1.13 E+00
Trans-2-Hexene	4050-45-7	Non-aromatic (alkene)	Air	kg	1.07 E+00

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor kg C_2H_4 eq.
Trans-2-Pentene	646-04-8	Non-aromatic (alkene)	Air	kg	1.12 E+00
Trans-Dichloroethylene	156-60-5	Halogenated Non-aromatic	Air	kg	3.92 E-01
Trichloroethylene	79-01-6	Halogenated Non-aromatic	Air	kg	3.25 E-01
Trichloromethane	67-66-3	Halogenated Non-aromatic	Air	kg	2.3 E-02
Note: To characterise a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the photochemical ozone formation indicator					

Table A.10 — Characterization factor of the abiotic resources depletion indicator – elements

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor Kg Sb eq,
Aluminium (Al)	7429-90-5	Element	Resources	kg	1.09 E-09
Antimony (Sb)	7440-36-0	Element	Resources	kg	1.00 E+00
Arsenic (As)	7440-38-2	Element	Resources	kg	2.97 E-03
Barium (Ba)	7440-39-3	Element	Resources	kg	6.04 E-06
Beryllium (Be)	7440-41-7	Element	Resources	kg	1.26 E-05
Bismuth (Bi)	7440-69-9	Element	Resources	kg	4.11 E-02
Boron (B)	7440-42-8	Element	Resources	kg	4.27 E-03
Bromine (Br)	7726-95-6	Element	Resources	kg	4.39 E-03
Cadmium (Cd)	7440-43-9	Element	Resources	kg	1.57 E-01
Chlorine (Cl)	7782-50-5	Element	Resources	kg	2.71 E-05
Chromium (Cr)	7440-47-3	Element	Resources	kg	4.43 E-04
Cobalt (Co)	7440-48-4	Element	Resources	kg	1.57 E-05
Copper (Cu)	7440-50-8	Element	Resources	kg	1.37 E-03
Gallium (Ga)	7440-55-3	Element	Resources	kg	1.46 E-07
Germanium (Ge)	7440-56-4	Element	Resources	kg	6.52 E-07
Gold (Au)	7440-57-5	Element	Resources	kg	5.20 E+01
Indium (In)	7440-74-6	Element	Resources	kg	6.89 E-03
Iodine (I2)	7553-56-2	Element	Resources	kg	2.50 E-02
Iron (Fe)	7439-89-6	Element	Resources	kg	5.24 E-08
Kalium (K; potassium)	7440-09-7	Element	Resources	kg	1.60 E-08
Lead (Pb)	7439-92-1	Element	Resources	kg	6.34 E-03
Lithium (Li)	7439-93-2	Element	Resources	kg	1.15 E-05
Magnesium (Mg)	7439-95-4	Element	Resources	kg	2.02 E-09
Manganese (Mn)	7439-96-5	Element	Resources	kg	2.54 E-06
Mercury (Hg)	7439-97-6	Element	Resources	kg	9.22 E-02

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor Kg Sb eq,
Molybdenum (Mo)	7439-98-7	Element	Resources	kg	1.78 E-02
Nickel (Ni)	7440-02-0	Element	Resources	kg	6.53 E-05
Niobium (Nb)	7440-03-1	Element	Resources	kg	1.93 E-05
Palladium (Pd)	7440-05-3	Element	Resources	kg	5.71 E-01
Phosphorus (P)	7723-14-0	Element	Resources	kg	5.52 E-06
Platinum (Pt)	7440-06-4	Element	Resources	kg	2.22 E+00
Rhenium (Re)	7440-15-5	Element	Resources	kg	6.03 E-01
Selenium (Se)	7782-49-2	Element	Resources	kg	1.94 E-01
Silicium (Si; silicon)	7440-21-3	Element	Resources	kg	1.40 E-11
Silver (Ag)	7440-22-4	Element	Resources	kg	1.18 E+00
Sodium (Na)	7440-23-5	Element	Resources	kg	5.50 E-08
Strontium (Sr)	7440-24-6	Element	Resources	kg	7.07 E-07
Sulphur (S)	7704-34-9	Element	Resources	kg	1.93 E-04
Tantalum (Ta)	7440-25-7	Element	Resources	kg	4.06 E-05
Tellurium (Te)	13494-80-9	Element	Resources	kg	4.07 E+01
Thallium (Tl)	7440-28-0	Element	Resources	kg	2.43 E-05
Tin (Sn)	7440-31-5	Element	Resources	kg	1.62 E-02
Titanium (Ti)	7440-32-6	Element	Resources	kg	2.79 E-08
Tungsten (W; Wolfram)	7440-33-7	Element	Resources	kg	4.52 E-03
Uranium (U)	7440-61-1	Element	Resources	kg	1.40 E-03
Vanadium (V)	7440-62-2	Element	Resources	kg	7.70 E-07
Yttrium (Y)	7440-65-5	Element	Resources	kg	5.69 E-07
Zinc (Zn)	7440-66-6	Element	Resources	kg	5.38 E-04
Zirconium (Zr)	7440-67-7	Element	Resources	kg	5.44 E-06
Note: To characterise a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the abiotic resources depletion indicator - elements					

Table A.11 — Characterization factor of the abiotic resources depletion indicator – fossil fuels

Substance	CAS no.	Group	Initial collection or emission compartment	Unit	Characterization factor MJ
Coal hard (27.91 MJ/kg)	Coal hard	Fossil fuel	Resources	kg	27.91
Coal soft, lignite (13.96 MJ/kg)	Brown coal	Fossil fuel	Resources	kg	13.96
Natural gas (38.84 MJ/m^3)	8006-14-2	Fossil fuel	Resources	m^3	38.84
Oil crude (41.87 MJ/kg)	8012-95-1	Fossil fuel	Resources	kg	41.87
Note 1: To characterise a substance, its quantity should be multiplied by the associated characterization factor. The sum of these characterized substances represents the value of the abiotic resources depletion indicator - fossil fuels					
Note 2: If any other more specific resource depletion values are known for fossil fuel abiotic resources, they shall be used However, their use shall be clearly documented.					

Table A.12 — Characterization factor of the water pollution indicator

Flow	Initial collection or emission compartment	Unit	Characterization factor (divide the quantity of flow by this coefficient) g/m3
Chemical Oxygen Demand (COD)	Water	g	125
BOD5 (Biochemical Oxygen Demand)	Water	g	30
Suspended solids (SS)	Water	g	35
Cyanide (CN-)	Water	g	0.1
AOX (adsorbable organic halogen)	Water	g	1
Hydrocarbons (not specified)	Water	g	10
Nitrogenous compounds (in N)	Water	g	30
Phosphorus-containing compounds (in P)	Water	g	10
Organic fluorine compounds (in F)	Water	g	15
Inorganic fluorine compounds (in F)	Water	g	15
Non-specified fluorine compounds (in F)	Water	g	15
Organic chlorine compounds (in Cl)	Water	g	0.1 a)
Non-specified chlorine compounds (in Cl)	Water	g	0.1 a)
HAP (non specified)	Water	g	0.1
Metals (non specified)	Water	g	1 b)
Aluminium and its compounds (in Al)	Water	g	5
Arsenic and its compounds (in As)	Water	g	0.05
Cadmium and its compounds (in Cd)	Water	g	0.2
Chromium and its compounds (in Cr)	Water	g	0.5 c)
Hexavalent chromium (for example, chromates, etc.)	Water	g	0.1
Copper and its compounds (in Cu)	Water	g	0.5
(Tin and its compounds (in Sn	Water	g	2
Iron and its compounds (in Fe)	Water	g	5
Mercury and its compounds (in Hg)	Water	g	0.05
Nickel and its compounds (in Ni)	Water	g	0.5
Lead and its compounds (in Pb)	Water	g	0.5
Zinc and its compounds (in Zn)	Water	g	2
Arsenic and its compounds (in As)	Soil	g	0.05
Biocides	Soil	g	0.05 d)
Cadmium and its compounds (in Cd)	Soil	g	0.2
Chromium and its compounds (in Cr)	Soil	g	0.5
Hexavalent chromium (for exampla chromates)	Soil	g	0.1
Copper and its compounds (in Cu)	Soil	g	0.5
Tin and its compounds (in Sn)	Soil	g	2
Iron and its compounds (in Fe)	Soil	g	5
Lead and its compounds (in Pb)	Soil	g	0.5
Mercury and its compounds (in Hg)	Soil	g	0.05
Nickel and its compounds (in Ni)	Soil	g	0.5
Zinc and its compounds (in Zn)	Soil	g	2
Heavy metals (non specified)	Soil	g	0.5 c)
a) Similar to trichloroethylene and perchlorethylene b) Similar to an intermediate value between zinc (Zn) and lead (Pb) c) Similar to lead (Pb). d) Similar to Annex V-A of the amended decree dated February 1998 on the collection and consumption of water and emissions of all types from facilities classified for environmental protection, subject to authorisation.			
Note: To characterise a substance, its quantity should be divided by the associated characterization factor. The sum of these characterized flows represents the value of the water pollution indicator			

NOTE for the aggregation of emission flows, the rules in the VADEMECUM of LCA procedures (AIMCC) should be used.

Table A.13 — Characterization factor of the air pollution indicator

Flux	Initial collection or emission compartment	Unit	Characterization factor (divide the quantity of flow by this coefficient) *g/m3*
Hydrocarbons (not specified)	Air	g	0.110
Hydrocarbons (not specified, except methane)	Air	g	0.110
HAP (non specified)	Air	g	0.001 a)
Volatile organic compounds (e.g.: acetone, acetate, etc.)	Air	g	0.110
Carbon monoxide (CO)	Air	g	0.100
Nitrogen oxides (NOx in NO2)	Air	g	0.500
Dinitrogen oxide (N2O)	Air	g	0.500 b)
Ammonia (NH3)	Air	g	0.050
Dust (non specified)	Air	g	0.040
Sulphur oxides (SOx in SO2)	Air	g	0.300
Hydrogen sulfide (H2S)	Air	g	0.005
Hydrocyanic acid (HCN)	Air	g	0.005
Organic chlorine compounds (in Cl)	Air	g	0.050 c)
Hydrochloric acid (HCl)	Air	g	0.050
Non-specified chlorine compounds (in Cl)	Air	g	0.050 c)
Organic fluorine compounds (in F)	Air	g	0.005 d)
Inorganic fluorine compounds (in F)	Air	g	0.005 d)
Halogenated compounds (non specified)	Air	g	0.005 d)
Non-specified fluorine compounds (in F)	Air	g	0.005 d)
Metals (non specified)	Air	g	0.005
Antimony and its compounds (in Sb)	Air	g	0.005
Arsenic and its compounds (in As)	Air	g	0.001
Cadmium and its compounds (in Cd)	Air	g	0.00005
Chromium and its compounds (in Cr)	Air	g	0.005
Cobalt and its compounds (in Co)	Air	g	0.005
Copper and its compounds (in Cu)	Air	g	0.005
Tin and its compounds (in Sn)	Air	g	0.005
Manganese and its compounds (in Mn)	Air	g	0.005
Mercury and its compounds (in Hg)	Air	g	0.00005
Nickel and its compounds (in Ni)	Air	g	0.005
Lead and its compounds (in Pb)	Air	g	0.001
Selenium and its compounds (in Se)	Air	g	0.001
Tellurium and its compounds (in Te)	Air	g	0.001
Zinc and its compounds (in Zn)	Air	g	0.005
Vanadium and its compounds (in V)	Air	g	0.005
Silicon and its compounds (in Si)	Air	g	0.040 e)
a) Similar to arsenic. b) Similar to NO2. c) Similar to HCL. d) Similar to HF. e) Similar to non-specified dust.			
Note: To characterise a substance, its quantity should be divided by the associated characterization factor. The sum of these characterized flows represents the value of the air pollution indicator			

NOTE for the aggregation of emission flows, the rules in the VADEMECUM of LCA procedures (AIMCC) should be used.

Table A.14 — Sources of the life cycle impact assessment models (LCIA)

Characterization factors	LCIA models
100-year global warming potential GWP	Global Warming Potential for a 100-year time horizon as in IPCC: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment. Report of the Intergovernmental Panel on Climate Change. [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]
Tropospheric ozone creation potential POCP	Jenkin, M.E. & G. Hayman, 1999: Photochemical ozone creation potentials for oxygenated volatile organic compounds: sensitivity to variations in kinetic and mechanistic parameters. Atmospheric Environment 33: 1775-1293. Derwent, R.G., M.E. Jenkin, S.M. Saunders & M.J. Pilling, 1998. Photochemical ozone creation potentials for organic compounds in Northwest Europe calculated with a master chemical mechanism. Atmospheric Environment, 32. p 2429-2441.
Stratospheric Ozone Depletion Potential (stable state) ODP	Ozone Depletion Potentials for Steady-state as in WMO (World Meteorological Organisation): Scientific assessment of ozone depletion. Global Ozone Research and Monitoring Project Reports. 2003
Acidification potential of soil and water (total average for Europe) AP	Acidification Potentials for average Europe total as in Huijbregts, M., 1999b: Life cycle impact assessment of acidifying and eutrophying air pollutants. Calculation of equivalency factors with RAINS-LCA. Interfaculty Department of Environmental Science, Faculty of Environmental Science, University of Amsterdam, The Netherlands.
Eutrophication potential EP	Heijungs, R., J. Guinée, G. Huppes, R.M. Lankreijer, H.A. Udo de Haes, A. Wegener Sleeswijk, A.M.M. Ansems, P.G. Eggels, R. van Duin, H.P. de Goede, 1992: Environmental Life Cycle
Abiotic Resource Depletion Potential (ultimate reserves) ADP	Abiotic Resource Depletion Potentials for ultimate ultimate reserves as in Oers, L.F.C.M., van & Koning, A., de & Guinée, J.B. & Huppes, G., 2002. Abiotic resource depletion in LCA: improving characterization factors for abiotic depletion as recommended in the new Dutch LCA Handbook. Delft: Ministry of Transport, Public Works and Water Management.
Water Pollution WP	NF P 01-010: 2004 according to clause 32 of the amended order, dated 2 February 1998, on the collection and consumption of water and emissions of all types from facilities classified for environmental protection, subject to authorisation.
Air pollution AP	NF P 01-010: 2004 according to clause 27 of the amended order, dated 2 February 1998, on the collection and consumption of water and emissions of all types from facilities classified for environmental protection, subject to authorisation.

Appendix B: Definition of the validity framework for a joint declaration

B.1 General

The content of the framework of validity should provide information allowing:

- the homogeneity of a joint declaration to be demonstrated
- the products covered by the joint declaration and the marketing entities boasting a joint declaration to be clearly identified.

The framework of validity shall be provided by the declaring party that sends the joint declaration. A marketing entity wishing to refer to a joint declaration shall declare the information allowing it to demonstrate compliance with the framework of validity.

B.2 Homogeneity

Life cycle assessments (LCA) use a great deal of data and many hypotheses. Some data are collected in situ, some is calculated and some estimated. The LCA input data therefore induces a certain degree of uncertainty. Consequently, the LCA result is more or less affected by variations in input data.

The environmental impacts of products placed on the market by different marketing entities using the same joint declaration should be homogeneous. A joint declaration therefore covers environmentally homogeneous products if it can be guaranteed that the environmental impacts of all the products covered do not exceed a given limit, provided that they remain within the framework of validity associated with the joint declaration.

It is accepted that this homogeneity need only be demonstrated for certain reference environmental indicators.

The homogeneity of environmental indicators arising from an LCA shall be demonstrated by conducting a sensitivity study of the uncertain parameters and of the parameters that vary from one marketing entity to another. It is strongly advisable to carry out the study as early as possible in the LCA process and to base the joint declaration on this study.

B.3 Sensitivity study

The stages of an LCA sensitivity study are as follows:

1. Selection of reference environmental indicators;
2. Identification of sensitive parameters: a study of contributors, in order to identify the input parameters that represent the most important contribution to the value of the reference environmental indicators (results of the LCA)
3. Determination of the range of variation of the sensitive parameters (range boundaries and, possibly, statistical distribution)
4. Parameterised simulations based on stages 2 and 3.

The sensitivity study can be iterative.

The result of the sensitivity study shall consist of:

a) a list of factors influencing the LCA results (sensitive parameters) and their permitted range of variation (this list constitutes the scope of validity)

b) for each reference environmental indicator, a probable range of variation (confidence interval of 95%) in the environmental indicator values, obtained by parameterised simulations.

The range of variation shall be provided for the most significant stage and total life cycle.

B.3.1 Stage 1: Selection of reference environmental indicators

The selection of reference environmental indicators shall be reasonable. They can be chosen on a case-by-case basis from the indicators included in Appendix A. Their selection shall be explained. At least the following indicators shall be studied:

- global warming or climate change,
- resource depletion,
- eutrophication,
- use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw materials or energy indicator - non-renewable energy,
- disposal of non-hazardous waste.

B.3.2 Stage 2: Identification of sensitive parameters

The sensitive parameters shall be studied for each reference environmental indicator. A first approach based on the distribution of the impacts between the processes included in the life cycle is therefore recommended. This study is based on a reference scenario described in the sensitivity study.

All the processes that are responsible for a contribution of more than 5% to the aspect in the reference scenario should be scrutinised. The parameters (process input or output, internal process modelling) of the LCA model that cause variations in this contribution should be identified. They are the so-called sensitive parameters.

At the end of this study, the declaring party will have a list of the processes making the largest contribution to the reference environmental indicators throughout the life cycle, as well as a list of sensitive parameters.

B.3.3 Stage 3: Definition of the range of variation of the sensitive parameters

This stage involves defining a range of variation for each sensitive parameter. The range shall at least be provided in the form of an interval. If known, a distribution law of the parameter in the previously defined interval can be provided.

At the end of this stage, each sensitive parameter is associated with a range of variation.

B.3.4 Stage 4: Parameterised simulations

This stage, which is based on stages 2 and 3, involves applying an appropriate mathematical model to determine the range of variation of the environmental indicators when the LCA model is subjected to variations in the sensitive parameters.
Stage 4 results in a set of intervals of values taken by each of the environmental indicators covered by the sensitivity study.

Stages 3 and 4 can be iterative in order to adapt the range of variation of the sensitive parameters to the required conditions of homogeneity.

B.4 Sensitivity study report

The report shall contain information corresponding to the four stages of the sensitivity study, the final result of the sensitivity study and, in particular, the range of validity of the joint declaration and the variation intervals of the environmental indicators.

B.5 Sensitivity study and declared environmental values

The results of the sensitivity study determine the environmental values declared in the joint declaration.

a) For a given environmental indicator, when the upper limit of the variation interval is under or equal to 1,4 multiply by the value of the center of the interval than the value declared shall be the center of the interval resulted from the sensitive study. On the contrary, the upper limit of a given environmental indicator shall be declared. For information, this upper limit corresponds to the maximum value that the environmental indicator can reach, with a probability of 95%.

   Note The center of interval corresponds to the overage of these limits.

   Example 1: variation of interval [70;90], center 80, 90/80<1,4, the value declared is 80

   Example 2: variation of interval [30;90], center 60, 90/60>1,4, the value declared is 80

b) For the other environmental indicators (non-reference indicators), the declared value can be the centre of the interval.

c) When an inventory has to be declared, the centres of the variation intervals of the flows shall be applied. The boundaries of the intervals can be optionally provided.

B.6 Precise identification of the products covered by a declaration

To determine whether a product can be covered by a joint declaration, it should be known whether the product is similar to the typical product covered and whether the marketing entity is entitled to use this joint declaration.

It is also important to check that the geographical, temporal and technological representativeness specified in the declaration corresponds to the product.

B.7 Identification of the typical product

The typical product should be correctly defined and described and match the functional unit as described in the declaration, in order to make it easier to compare the description of a product with that of the typical product.

The description of the typical product will contain at least:

a) a list of the main constituent parts or dominant materials

b) information on the functionality or level of performance

The identification quickly and unambiguously indicates whether a given product can be covered by the joint declaration.

B.8 Identification of marketing entities entitled to use the joint declaration

The list of marketing entities entitled to use a joint declaration shall be provided by the declaring party that issued the joint declaration:

- in the form of a comprehensive list of names
- in the form of a condition of membership of a collective entity (association, syndicate, signatories of a charter of best practice, etc.). In this case, the list of

members of this collective entity shall be available to the public, or proof of membership of the collective entity shall be provided by the marketing entity.

B.9 Content of the framework of validity

The framework of validity will contain:

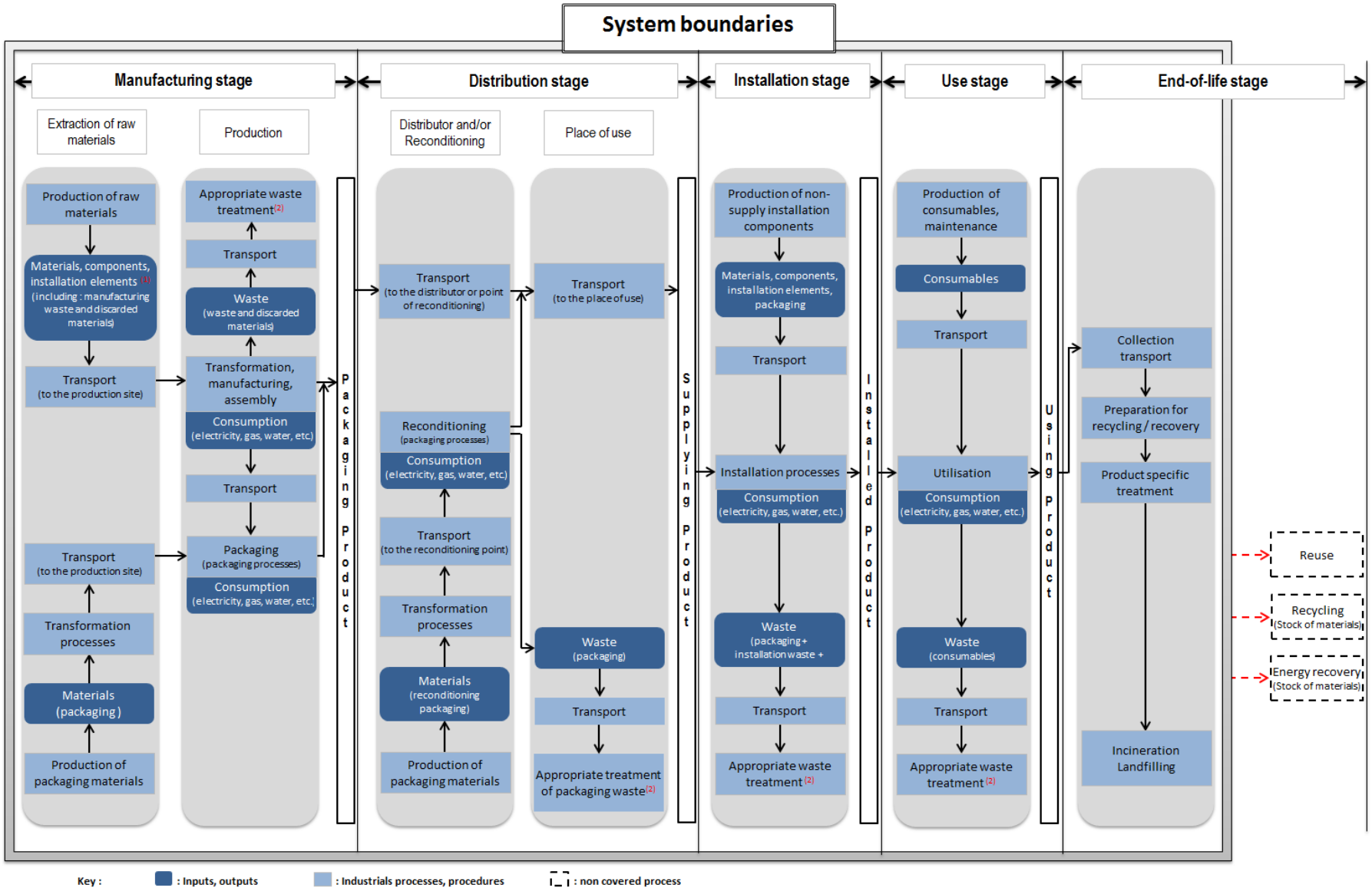
- the identification of the typical product,
- the identification of marketing entities entitled to use the joint declaration,
- the sensitivity study report, including the scope of validity and demonstrating that the declared values of environmental indicators are consistent.

B.10 Use of the framework of validity

To use a joint declaration for a product:

- the product should comply with the "typical product" covered by the joint declaration,
- the user of the declaration should appear in the list of users entitled to use this joint declaration,
- the product should comply with the scope of validity of this joint declaration.

Annexe C: Diagram of the system boundaries for the LCA



(1) : Installation elements supplied with the reference product.

(2) : Appropriate waste treatment taken into account for removal processes : landfilling, incineration without energy recovery, processing methods stock (cf. §2.2.7 and §2.5.6.)

Appendix D: Terms and definitions

The terms and definitions are given for information only. It can be used in full or in part in the environment declaration or supplemented by additional information.

Its purpose is to educate the customer and also to ensure that each term used has a corresponding definition which is either officially recognised or clearly defined.

Co-product
any of two or more products coming from the same unit process or product system

NOTE Two pieces of sheet metal from a single coil, but intended for two distinct products, are an example of co-products.
[ISO 14044:2006]

Eco-solution
products or services allowing a reduction in the environmental impacts of an installation

Proportional to the reference flow
impact which changes according to the quantities produced

Elementary flow
material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system under study that is released into the environment without subsequent human transformation

[ISO 14040:2006]

Environmental aspect
element of an organization's activities or products or services that can interact with the environment

[ISO 14050:2010]

Environmental impact
any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services

[ISO 14050:2010]

Functional unit
quantified performance of a product system for use as a reference unit in a life cycle assessment

[ISO 14040:2006]

Hazardous waste
specific waste with a certain degree of toxicity that necessitates special treatment (as indicated in Directive 91/689/EC and decision 2532 EC)

Homogeneous environmental family
group of products matching the same functional unit, the environmental impacts of which are identical to the reference product or can be extrapolated, possibly by applying a defined calculation rule

NOTE This functional unit may involve different levels of service delivered, e.g. power strips)

Impact category
class representing environmental issues of concern to which life cycle inventory analysis results may be assigned.

[ISO 14040:2006]

Impact category indicator
quantifiable representation of an impact category

[ISO 14040:2006]

Input
product, material or energy flow that enters a unit process

[ISO 14040:2006]

Intermediate flow
product, material or energy flow occurring between unit processes of the product system being studied

[ISO 14040:2006]

Joint environmental declaration
environmental declaration on a "typical product" included in the same category product representing similar products marketed by different entities

Life Cycle Assessment (LCA)
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[ISO 14040:2006]

Life cycle inventory dataset
set of life cycle inventory data on a material, a component or a generic process, available in a database to conduct life cycle assessments at a higher level of integration

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

[ISO 14040:2006]

Life cycle inventory analysis (LCI)
phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a given product system throughout its life cycle

[ISO 14040:2006]

Non-hazardous waste
non-toxic waste similar to household waste.

Output
product, material or energy flow that leaves a unit process

[ISO 14040:2006]

Primary data
input or output measured on a site or a real specific process

Product Category Rules (PCR)
set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories

[ISO 14025:2010]

Product-Specific Rules (PSR)
set of additional specific rules, requirements and guidelines for developing Type III environmental declarations for a product category

Product system
collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product

[ISO 14040:2006]

Raw material
Primary or secondary material that is used to produce a product

NOTE Secondary material includes recycled material

[ISO 14040: 2006]

Reconditioning packaging
additional or replacement packaging for a product provided during the distribution stage

Recyclability
fitness of components, materials or both to be removed from the end-of-life flow and recycled

[ISO 22628:2002]

Recyclability rate
percentage of the mass of an item of equipment that may potentially be recycled or reused

[ISO 22628:2002]

Recycling
any operation by which waste materials are used in a manufacturing process for the same initial use or other uses, excluding use as a form of energy

[ISO 22628:2002]

Reference flow
measure of the outputs from processes in a given product system necessary to fulfil the function expressed by the functional unit

[ISO 14044:2006]

Reference life time (RLT)
life time that may be expected according to a particular set (reference set) of conditions of use and that may be used to estimate the life time under other conditions of use

[ISO 21930:2007, 3.25 modified "construction product" by "equipment"]

NOTE The reference life time is also referred to as "typical". This is a theoretical period used for calculation purposes. It can never be compared to the minimum, average or actual life times of the products.

Reference product
product or product system, supplied by the manufacturer, modelled in the LCA and allowing the defined functional unit to be matched

Reusability
fitness of components to be removed from the end-of-life flow and reused

[ISO 22628:2002]

Secondary data
Input or output data not from direct measurement, but either from published sources, statistics or data sources (e.g. commercial databases and free databases) used to substitute primary data

Secondary fuel
fuel recovered after a first use or retrieved from waste, that replaces primary fuels

[EN 15804:2012+A1:2013]

Specific LCI

LCI conducted for a material, component, subassembly or product based on primary data

System boundary
set of criteria specifying which unit processes are part of a product system

[ISO 14040:2006]

Unit process
smallest element considered in the life cycle inventory analysis for which input and output data are quantified

[ISO 14044:2006]

Appendix E: Bibliography

ISO 14025:2010 "Environmental labels and declarations - Type III environmental declarations - Principles and procedures"

ISO 14040:2006 "Environmental management – Life cycle assessment – Principles and framework"

ISO 14044:2006 "Environmental management – Life cycle assessment – Requirements and guidelines"

IEC/TR 62635:2012 "Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment"

IEC 62474:2012 March 2012 "Material Declaration for Products of and for the Electrotechnical Industry"

ELCD: European Reference Life Cycle Database, Joint Research Center

EN 15804:2012+A1:2013: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (ERP).

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

AP0012: document PEP-AP0012–ed 2-EN- "LCA report content" available from the PEP ecopassport® program

AP0008: document PEP-AP0008-ed 2-EN- "Editorial rules" available from the PEP ecopassport® program website

Appendix F: Critical review

The results of the PCR review as well as comments and recommendations made by the panel are available on request from the PEP association.

Extract from the final report of the panel:

"Composition of the panel

The CR panel consisted of the following members:

- Dipl. Eng. Philippe Osset, CEO Solinnen. Philippe has acted as the chair of the Critical Review panel.
- Dipl. Eng. Julie Orgelet, LCA & Ecodesign Expert, Operationnal Manager at Bureau Veritas (BV) Codde.
- Mastère Pierre Ravel, Research and Studies Engineer, at « Division Environnement et Ingénierie du Cycle de Vie » of the « Centre Scientifique et Technique du Bâtiment (CSTB) »

The intention of the panel composition was to make available, at the panel level, competencies which covered the required competencies (according to ISO 14025:2010 – 8.2.3) for such CR:

- the knowledge of the sector, of the products and the environmental aspects associated to them,
- LCA expertise,
- the knowledge of the reference standards,
- expertise in LCA and PCR/PSR CR making,
- knowledge of the Association PEP ecopassport® Program.

Each of the three experts of the panel has competency on each of these five aspects.

The panel has acted independently from Association PEP ecopassport® and from the participants of the work group in charge of the redaction of the reviewed PCR.

Nature of the CR work, CR process and limitations

The CR panel has worked according to the requirements of ISO 14025:2010 concerning CR of PCR. According to ISO 14025:2010 – 8.1.2., the critical review process has worked in order to check if:

- "the PCR have been developed in accordance with the ISO 14040 series of standards and, specifically, in accordance with 6.7.1 of this [ISO 14025:2010] International Standard,
- the PCR fulfil the general program instructions, and
- the LCA-based data, together with the additional environmental information prescribed by the PCR, give a description of the significant environmental aspects of the product".

AFNOR XP C 08-100-1:2014 has been used by Association PEP ecopassport® as a reference. Moreover, since the present document is supplemented with PSR (that will be also independently reviewed), no environmental nor process data, such as LCI, has been individually reviewed during the present work. This is a limitation to the CR work.

The first goal of the CR was *to provide* Association PEP ecopassport® with detailed comments in order to allow Association PEP ecopassport® to improve its work, i.e. the PCR. These comments have covered the content of the document, including methodology choices. Additionally, the present final CR report *provides the future reader* of the Association PEP ecopassport® report with information that will help understanding the PCR content and choices.

The reference documents that have been used to produce comments were the following:

- ISO 14025:2010, ISO 14040:2006 and ISO 14044:2006,
- NF EN 15804+A1:2014,
- NF XP C 08-100-1:2014,
- The expectations of the French regulation as stated in Décret n° 2013-1264 of the 23rd of December 2013 and "Arrêté" of the 23rd December 2013, as far as it was useful, waiting for a more specific "Arrêté" to be published.

The on-going development of ISO/NP TS 14027 has also been taken into account during the review, including the definition of "Core Rules".

The CR work has started after the generation of a first PCR by Association PEP ecopassport®. The work has started 20th of June 2014 and ended up in February 2015. During this period, different oral and written exchanges have been held between the CR panel and Association PEP ecopassport®, including clarification exchanges regarding the CR comments, and the production of two new versions of the PCR by Association PEP ecopassport®. Association PEP ecopassport® has taken into account most of the comments and significantly modified and improved its PCR.

The present final CR report is the synthesis of the final comments by the reviewers. Some detailed comments are provided within this final CR report, together with the full detailed exchanges as appendices.

The present CR report is delivered to Association PEP ecopassport®. The CR panel cannot be held responsible of the use of its work by any third party. The conclusions of the CR panel cover the full PCR from Association PEP ecopassport® "Product Category Definition Rules" of the PEP ecopassport® PROGRAM Environmental Profiles for Electrical, Electronic and HVAC-R Products – February 2015" and no other report, extract or publication which may eventually been done. The CR panel conclusions have been set given the current state of the art and the information which has been received. These CR panel conclusions could have been different in a different context.

CR Statement

The CR first set of 241 comments covered the following issues:

- general (34 comments)
- methodology (113 comments),
- editorial (99 comments),
- other (data, technology, interpretation… 24 comments).

(the total is higher than 241 since some comments were covering different issues).

A huge work has been done by Association PEP ecopassport® to provide a final PCR integrating answers to the CR points, and the final PCR has significantly improved as compared to the first one.

As a whole, the CR panel considers that the final PCR covers the goals which have been set up by Association PEP ecopassport®, and may be used as "core rules" for PEP development of Electrical, Electronic and Heating Ventilation Air Conditioning-Refrigeration (HVAC-R) products covered by the Program.

Detailed comments

The final structure of the PCR reflects the ISO 14025:2010 requirements. The following lines bring some highlights that a reader of the final PCR may use to assist his reading and understanding of the PCR. They recap some critical comments which were not addressed in a way which is different from what the CR panel expected. The reading of the detailed comments and answers (see appendices) is recommended to know more.

Methodology comments

According to chapter 2.2.2 of the reviewed PCR and the CR exchanges, it is not mandatory to **distinguish the use and maintenance** phases environmental impacts, since it is sometimes very difficult to do so. This will allow some PEP to present aggregated results for these two phases. It is a methodology issue when considering the use of PEP for environmentally conscious designed buildings. It would have been appropriated to share impacts between these two phases, even if this approach is not "mandatory" from the point of view of the general LCA perspective. It would have been consistent with what is presented in the NF EN 15804+A1:2014.

The **"stock" method** has been chosen within the PCR to cover end of life issues (as presented in 2.5.6 of the PCR). According to the Association PEP ecopassport®, this is due to poor quality data as far as recycling of the covered products is concerned. Additionally, this choice is said to promote the "use of secondary scraps instead of virgin resources". The optional "Module D" approach as described in NF EN 15804+A1:2014 would have been preferable since no revision of the PCR would have been needed when end of life data will be available – giving the fact that some data are already available. It would have been consistent with what is presented in the NF EN 15804+A1:2014. Additionally (for clarification), the "Module D" approach is said to promote "the avoidance of production of waste during a life cycle". "Module D" and "Stock" approaches might induce different behavior effects, which might have an influence on resources depletion.

Waste indicators help to reflect the efforts which are done to limit the amount of waste during the life cycle of the products covered by the PCR (as said in the previous paragraph). Since all public databases allow getting this information, and in line with the European Eco-design Directives and current actions towards circular economy, it would have been appropriated to request at least one waste indicator as "mandatory" and not as "optional" (as said in 2.12.2).

Reference life time (RLT). As the RLT is an important parameter for product environmental assessment, the PCR could give more requirements for RLT assessment such as requirements referenced in ISO 15686-1:2011, Buildings and constructed assets — Service life planning — Part 1: General principles and framework. This point could be improved in a next version of the PCR.

Data quality evaluation: more requirements could have been specify concerning terms of time-related, geographic and technologic coverage for data quality evaluation. Guideline given in FD CEN/TR 15941:2010 could have been reused. This point could be improved in a next version of the PCR.

Impact categories calculations methodology: the PCR is based on CML - version 4.2 methods whereas EN 15804+A1 (2014) is based on version 4.1 of CML method. It induced some minor deviations that can lead to difference in the results. In the case of comparison or aggregation of environmental product declaration, it can lead to inconsistencies. As a consequence, for the next version of the PCR, the consistency between the different referential should be insured.

Other

The choice of some **ELCD data sets**, which is sometimes mandatory (e.g. as stated in 2.5.6), may be understood since this choice will help to get consistency between PEP, at French and European level. The *data issue* comes from the fact that this ELCD database is, so far, not actively maintained by ELCD (obsolete data are found in it), and consistency between the data set which are included in ELCD is, so far, not ensured nor centrally reviewed. Additionally, some methodology choices done within some ELCD data sets may be fundamentally different from some methodology choices of the review PCR. The CR panel highlight that a strong care will have to be put when dealing with this issue in the (close) future: update of the PCR (from that point of view) might be needed to reflect LCA data sets development, including when strong changes will have occurred between current data sets and ELCD data sets.

"**Additional information**" could have been identified with more details, and listed within the PCR. They should not be used for extrapolated product or collective declaration without a specific verification.

When the practice of "**collective declaration**" will be more mature, the annex detailing the way to do it should be improved by providing more detailed guidance, including sensitivity analysis methodology. "