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Environmental Performance Assessment Method for Construction Works

Calculation method to determine environmental performance of construction works throughout their service life, based on EN 15804.

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1. Introduction

1.1. General

The Environmental Performance Assessment Method for Construction Works (hereinafter referred to as Assessment Method) was developed for unambiguous and verifiable[1] calculation of material-related environmental performance of construction works. The Assessment Method forms a cohesive package with the National Environmental Database (NMD) and the calculation rules, all of which are administered by Stichting National Environmental Database (Stichting NMD).

The European standard EN 15804:2012+A2:2019 (hereinafter referred to as EN 15804) forms the basis for this Assessment Method. EN 15804 was developed for Environmental Product Declarations (EPDs) at product level. In this version of the Assessment Method, EN 15804:2012+A1:2013 has also been considered exclusively for the purpose of determining characterised impact scores (See 2.6.5). Specific agreements for producing and using EPDs for material-related assessment at construction work level in the Dutch context are included in this Assessment Method.

The most important additions to / deviations from EN 15804 are:

1. In addition to EN 15804:2012+A1:2013, there are additional environmental impact indicators relating to human and ecotoxicity. Without these indicators, some desirable environmental improvements, such as the use of air scrubbers to assess air quality would not be assessed positively.
2. Specific standard values are prescribed for several processes. This is necessary to avoid unjustified differences between construction products when calculating the environmental performance of construction works.
3. Reference is made to a process database for raw materials and basic processes.
4. Future scenarios are permitted in the product scenarios within certain conditions, making it possible to include product scenarios at the start of their life cycle.

NEN-EN 15978 (hereinafter EN 15978) was published to assess the environmental performance of buildings. EN 15804 is based on this standard and the construction calculation is therefore also based on the EN 15978 system. A decision was made not to follow EN 15978 explicitly as EN 15978 only supplements EN 15804 for material-related environmental performance of buildings to a limited extent and also covers the use phase of the building itself (heating, cooling, etc.). EN 15978 also focuses exclusively on buildings, while the Assessment Method applies equally to civil engineering structures. As well as EN 15978, a specific EN standard will probably be formulated in CEN TC 350 for the environmental performance of civil engineering structures. The Assessment Method already focuses on both applications (C&U and civil engineering).

The specific Dutch implementation of EN 15804 in the Assessment Method and its use in building regulations and tender procedures for civil engineering structures requires that environmental performance calculations of buildings and structures adhere strictly to the (Assessment Method) implementation of EN 15804. This adherence safeguards the use of equivalent environmental data.

[1] *In this version of the Assessment Method 'construction works' replaces 'buildings (in practice sometimes referred to as C&U) and civil engineering structures'. Construction works are also understood to mean buildings. Civil engineering involves rail projects, earthworks, roadworks and waterway construction. In this context, it refers more broadly to the entire infrastructure sector, including, for example, railway construction and energy infrastructure.*

Additional choices need to be made in calculating the environmental performance of construction works. These are recorded explicitly below. This concerns:

- determining scenarios and standard values for the Dutch context, where possible and necessary;
- the use of generic data (non-proprietary data) if no producer or sector specific data are available.

In chapter 2, the Assessment Method offers directions for formulating Environmental Product Declarations (EPDs) in the Dutch context in such a way that the environmental information they contain is suitable for inclusion in the NMD. Chapter 2 also indicates which environmental information must be supplied for the NMD and in which form. The Assessment Method comprises agreements that are generic for construction works in general (applying to both buildings and civil engineering structures) and agreements that are specific to buildings or civil engineering structures.

Appendix I includes the terms, definitions & abbreviations used in this Assessment Method.

The Assessment Method cannot be read as a stand-alone document. Knowledge of the underlying standards, particularly EN 15804, ISO 14044 and ISO 14025, is needed to produce an EPD in accordance with the Assessment Method.

1.2. National Environmental Database

The NMD, managed by Stichting NMD, was established to enable unambiguous calculation of environmental performance of construction works in the Dutch context. The NMD contains information about products formulated in accordance with the Assessment Method in the form of product cards that refer to environmental profiles. These product cards and environmental profiles are used in various calculation tools to calculate the environmental performance of construction works. Together with the calculation rules described in 'Calculation rules and guidelines for assessing environmental performance' (see *www.milieudatabase.nl* for the most recent version), this ensures verifiable, reproducible and unambiguous calculation results.

There are three product information categories in the NMD:

- Category 1: proprietary data, verified by an independent, qualified third party in accordance with the NMD Verification protocol.
  For whom: manufacturers/producers, suppliers.
- Category 2: non-proprietary data, verified by an independent, qualified third party in accordance with the NMD Verification protocol, including a statement of representativeness, for example, for the Dutch Market or a group of producers, and mentioning the participating companies.
  For whom: groups of manufacturers, suppliers, sectors, governments, etc.
- Category 3: non-proprietary data, owned and managed by Stichting NMD and not verified according to the NMD Verification protocol. All procedures relating to category 3 product information are included in Appendix II.
  Public availability: underlying data (structure of product card and basic profiles) are publicly available via the Stichting NMD website: *www.milieudatabase.nl*

Categories 1 and 2 data that are included in the NMD are supplied by construction product producers and sectors. They also remain owners of the environmental profiles. The Assessment Method serves as a product category rule (PCR) for the Life Cycle Assessment (LCA) that is carried out in order to produce an Environmental Product Declaration (EPD). This makes the environmental information from the EPDs suitable for inclusion in the NMD as category 1 and category 2 product information. The Assessment Method therefore indicates how EPDs should be formulated as these supply information for the product cards. EPDs are in line with EN 15804. The Assessment Method is a generic PCR for construction products. In addition to the Assessment Method, sectors produce product-specific product category rules (PCRs).

Category 3 data are a catch-all solution to provide environmental profiles in the NMD in the absence of, and as a counterpart to, category 1 and category 2 data for a construction product. Stichting NMD is owner of these environmental profiles, which are formulated under Stichting NMD's responsibility or were submitted by a sector in the past.

A surcharge factor is applied to category 3 environmental profiles, because experience has shown that unverified environmental profiles often indicate a too low environmental impact as the inventory data are less complete, and to stimulate the submission of category 1 and 2 data to the database. This surcharge factor is determined by Stichting NMD, which administers the NMD, and is implemented in the calculation tools via the calculation rules. An overview of the agreements and procedures for category 3 product cards is included in Appendix II.

As well as the product cards in the NMD, Stichting NMD also manages the process database. This is an LCA database of raw materials and background processes based on Ecoinvent 3.6[2] 'allocation, cut-off by classification' and adjusted for use in the context of the Assessment Method. The process database forms a generic basis for LCA practitioners and EPD compilers, if no specific data are available, as included in section 2.6.3.6. In that case, the representativeness of these processes should always also be considered in the LCA report on which the EPD is based. Category 3 data are modelled according to processes from the NMD process database, which means that Category 3 data are updated following any changes in Ecoinvent or the Assessment Method.

The Assessment Method, the calculation rules, the NMD and the process database are a cohesive package that enable an unambiguous calculation of the environmental performance of construction works. The figure below indicates that the Assessment Method serves both as a product category rule (PCR) to produce EPDs as well as to determine the calculation rules for the core of the calculation tools.

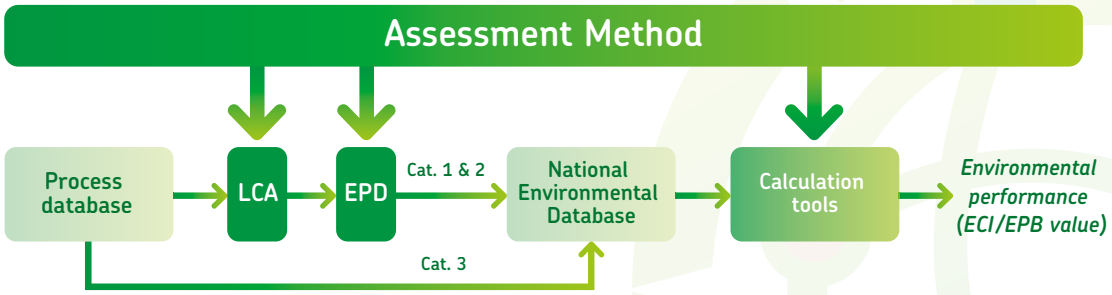


Figure 1: Visualisation of the cohesion between the two databases managed by Stichting NMD, the environmental performance and the elements for which the Assessment Method prescribes requirements.

[2] *Files based on version 3.5 will still be accepted until 1 July 2021. Appendix II includes information on how changes to the used Ecoinvent can be implemented.*

1.3. Verification of category 1 and 2 product information

Environmental data incorporated in the NMD in accordance with this Assessment Method are verified in compliance with the procedure and requirements of the latest NMD Verification protocol version. The NMD Verification protocol (July 2020) and the Verification Checklist on the PCR-NL (May 2021) correspond in terms of content. Both the EPD, including the entire underlying project documentation, as well as the entire input form part of the verification. The input is verified in the NMD 3.0 input interface as made available to Stichting NMD's recognised experts. The EPD compiler is responsible for checking the latest version of the NMD Verification protocol and the submission format. Earlier versions can no longer be processed once any transitional period has expired.

To enable assessment according to the NMD Assessment Protocol, the LCA practitioner should complete the Assessment Tables document in the comments' column where the requested information can be found in the project file and add this completed document to the project file. The document with the assessment tables is available as a Word file on the Stichting NMD website, *www.milieudatabase.nl*. The assessment tables form a basis for the verification. The LCA principles from the core standards (see normative references in section 2.2) are also checked during verification.

1.4. Reading guide

This version of the Assessment Method replaces the January 2019 version 3.0 and the three amendments.

The methodical requirements for the LCA and the product information based on EN 15804 are presented in chapter 2. Chapter 2 follows the EN 15804 section layout. Supplements to EN 15804 are indicated for each section, if applicable. As well as the additions to EN 15804, clarifying texts have been included that help produce unambiguous environmental information.

The guidelines for an assessment at construction work level are presented in chapter 3.

Not all concepts are defined in the main text. If any definitions are missing, please refer to Appendix I.

2. Methodical requirements (EN 15804) to determine the environmental performance of construction and other products, installations and processes

This chapter can only be fully understood in combination with EN 15804 and follows almost the same chapter structure. In each section title, the title used in EN 15804 is included in brackets.

2.1. Goal and scope (EN 15804 1 Scope)

The product information (Environmental Product Declarations) is used for the construction calculations and must be suitable for use in the Dutch context and to achieve the intended uniformity. The rules in the Assessment Method are aligned to this goal.

In addition to EN 15804, the Assessment Method indicates

- requirements for determining standard scenarios for the Dutch context, where possible and necessary;
- requirements for determining standard values and background processes for the Dutch context, where possible and necessary;
- requirements for determining the reference service life;
- requirements for preparing the project file for the verification procedure.

The Assessment Method target group comprises:

- LCA practitioners for product cards for inclusion in the National Environmental Database (NMD);
- compilers of basic profiles for inclusion in the process database, for use as input for LCAs;
- instrument owners and managers of databases for producing uniform construction calculations in the Netherlands.

2.2. Normative references (EN 15804 2 Normative references)

The following documents are invaluable in using this document. For dated references, only the stated version applies. For undated references, the latest version of the document applies, including later addenda:

NEN-EN 15804 Sustainability of construction works - Product environmental declarations - Basic rules for the product group construction products.

In turn, EN 15804 is based on several international LCA standards, which therefore also apply to the Assessment Method:

ISO 14025:2010, Environmental labels and declarations – Type III environmental declarations – principles and procedures (ISO 14025:2006)

ISO 14044:2006 Environmental management – Life cycle assessment – requirements and guidelines (ISO 14044:2006)

EN 15978 and - Sustainability of structures – Assessment of the Environmental performance of buildings – Calculation method

As indicated under section 1.1, c-PCRs have also been developed in CEN/product TCs that have the status of EN standards.

2.3. Terms and definitions (EN 15804 3 Terms and definitions)

The terms and definitions are included in Appendix I. For all terms from EN 15804, the section number is included in brackets.

2.4. Abbreviations (EN 15804 4 Abbreviations)

The abbreviations are included in Appendix I. EN 15804 applies.

2.5. General aspects (EN 15804 5 General aspects)

2.5.1. Objective

EN 15804 applies.

Complementary product category rules (c-PCRs) may also apply. The cPCRs that meet the criteria must be adhered to when formulating category 1 and 2 data in line with the Assessment Method. For a current overview of mandatory c-PCRs, see the Stichting NMD website, *https://milieudatabase.nl/en/*.

2.5.2. Types of EPD and associated life cycle phases

In deviation from EN 15804, the LCA-based information in an EPD includes the following life cycle phases (see Figure 2):

or:

Only the production phase (A1-A3) as basic profile. These profiles are made available to LCA practitioners via the Stichting National Environmental Database (Stichting NMD) process database. These profiles are not issued as product cards for the calculation tools.

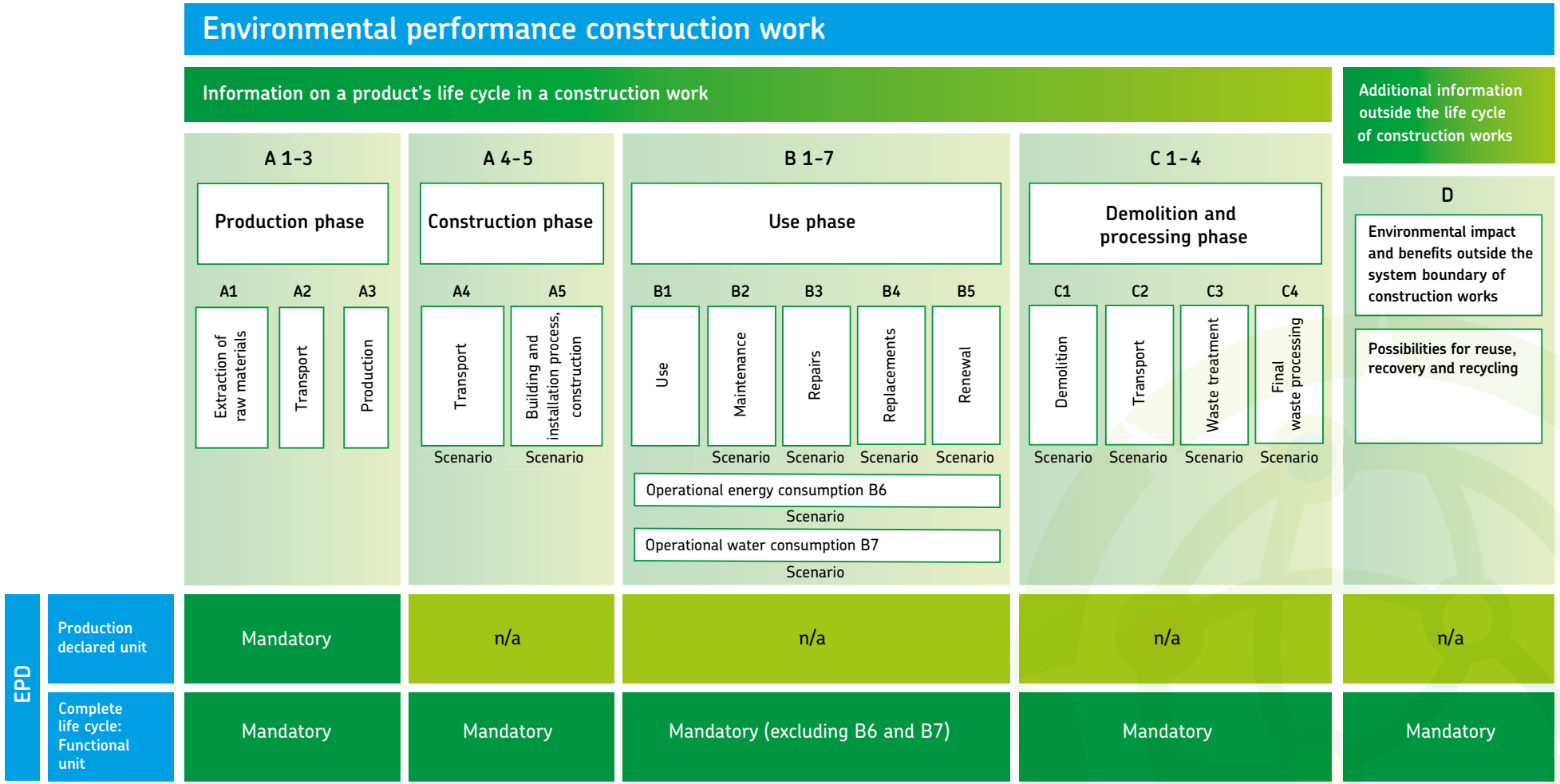
or:

The entire life cycle of a product in construction works, modules A to D (excluding B6 and B7). If no information is available from the LCA for the specific EPD, default values can be used for the use and maintenance phase of construction works.

The information per life cycle stage is arranged in a large number of information modules and in accordance with EN 15804: for example for phase A, the production phase, these are A1, A2, A3, A4 and A5. Modules A1-A3 are aggregated and included in the NMD.

For inclusion in the NMD as product card, basic profiles must be supplied about all relevant life cycle phases. If desired, these can also be included in the process database.

Figure 2: Life cycle phases EPD



2.5.3. Comparability of construction product EPDs

EN 15804 applies.

2.5.4. Additional information

EN 15804 applies.

The Assessment Method also offers indications for the information required for product cards.
See paragraph 2.8.2.2.

2.5.5. Ownership, responsibility and liability

EN 15804 applies.

2.5.6 Communication formats

Specific formats for the basic profiles and product cards are prescribed in 2.8.2.2. for inclusion of environmental data in the NMD.

For information: for MRPI certificates, the format is prescribed in the MRPI Verification protocol. It is Stichting MRPI's responsibility to ensure that this concurs with the NMD Verification protocol. For inclusion in the NMD, data must at least be checked against the latest version of the NMD Verification protocol. This can be done through verification based on the 'Verification Checklist on the PCR-NL'.

2.6. Product category rules for the LCA (EN 15804 6 PCR)

2.6.1. Product category

EN 15804 applies.

2.6.2. Life cycle phases and the information modules to be included

EN 15804 applies.

2.6.3. Calculation rules for the LCA

The reference unit of EPDs may refer to a declared unit or to a functional unit. An EPD must cover all relevant life cycle phases. If only a basic profile is supplied, modules A1 - A3 will suffice.

2.6.3.1. Functional unit or declared unit

EN 15804 applies.

The product's functional unit for including environmental information from the EPD in the NMD should be selected in accordance with the NMD functional descriptions and ordering structure.

A product is something that is marketed by the supplier and purchased by the buyer for use during the life cycle of a building or structure. A product can be a physical product (e.g. 1 m2 of window frame), but also an activity (e.g. 1 tkm of rail transport). For civil engineering it is relevant that a product can be a physical product as well as an activity. The NMD distinguishes total products and partial products. The required performance is recorded in functional descriptions per element (C&U) or chapter (civil engineering). The total products provide all the services required per element/chapter; the partial products provide only part. Both total as well as partial products are saved in the NMD as individual products. Information per product is saved in the NMD.

The products in the NMD have been assigned a unit in line with how they are traded on the market. These are also logical units for the materialisation of construction works in the validated calculation tools. Examples are a frame in m2 and hinges and locks per item. It is not logical to include hinges and locks in m^2.

A disadvantage is that any deviating units make product comparisons complex. Insight into the products that score better, or more poorly, is handy when optimising the design, which is why it is now also possible to express the ECI of a product per 'reference unit' of the element (component). Presenting this in both 'market unit' as well as in 'reference unit' concerns an additional functionality, which can be offered by the validated calculation tools. This other method of presentation is therefore a side issue and has no influence on environmental performance at construction work level.

The conversion factor in the calculation tools converts 'market units' into 'reference units'. This factor has been added to the product data in the NMD as an extra, which means that the factor falls within the product data quality control system.

The total overview is included in the NMD 3.0 input interface (inputting product cards NMD 3.0). An Excel version is also available on the Stichting NMD website. This concerns an exhaustive overview. If the proposed product does not occur within one or more desired functional descriptions, a request can be submitted to Stichting NMD to make adjustments or include a new functional description. **PLEASE NOTE: a product card that cannot be linked to the database cannot be included. The EPD compiler is responsible for identifying this in time and for submitting a request to Stichting NMD.**

Prior to including environmental data from the EPD in the NMD, the available environmental data must be supplemented with data for all relevant life cycle phases. Information modules B6 and B7 (see figure 2) are not taken into account here.

The declared unit must be measurable and must contain:

- a description of the building's or civil engineering structure's construction element;
- a specification of the building's or civil engineering structure's construction element;
- if applicable, the possible fields of application, expressed in categories or quality designations where necessary, together with the service life of the construction product or the building's or civil engineering structure's construction element where relevant;
- the amount of the construction product expressed in an SI unit or a combination of SI units;
- the weight of the construction product;
- the materialisation of the construction product in material description and weight.

Descriptions in certificates or statements of the construction product or building's or civil engineering structure's construction element are guiding, as are descriptions in sector-wide accepted documents, guidelines, methods and systems.

2.6.3.2. Functional unit

EN 15804 applies.

2.6.3.3. Declared unit

EN 15804 applies.

2.6.3.4. Reference service life

EN 15804 applies.

The reference service life is declared by the producer with substantiation. If this is not available, the reference service life per type of construction product from the publication Service life of construction products [SBR, 2011 - Knowledge database ISSO] can be used.

There are products that experts indicate have an average service life in standard situations of certainly more than 100 years. An example is a concrete foundation pile. It is assumed that the expected service life for this product is equivalent to that of the structure in which the product is used. These products are recognisable in the NMD by a product service life of 999 years. The calculation rules mean that for these products, the product service life used in the calculation is limited to the service life of the structure.

2.6.3.5. System boundaries

EN 15804 applies.

A process tree is produced within the system boundary in which at least the information modules from Figure 2 are distinguished: Production phase (A1-A3), Construction phase (with transport A4 and building and installation process/construction A5 separate), Use and maintenance phase (B1-B5, in separate modules), Demolition and processing phase (C1-C4, in separate modules) and module D.

A non-exhaustive but purely informative overview of processes that should and should not be incorporated is included in Annex III, System boundaries. This overview can be used as a checklist for both the compiler and verifier of an LCA for an EPD. The system boundaries must be reported in such a way that these are clearly verifiable for the verifier.

In accordance with EN 15804, waste processing is included in the life cycle phase in which it originates.

Production phase (A1-3)
EN 15804 applies.

Streams that lose their waste status and leave the production phase (A1-A3) must be allocated as by-products (see EN 15804 6.4.3.2). Environmental impact and avoided environmental impact of allocated by-products are not included in module D (see EN 15804 6.3.4.6). If such an allocation of by-products is not possible, other methods can be chosen, if substantiated.

PLEASE NOTE: If the LCA practitioner considers that another method is needed, different conditions for the verification apply. The proposed solution will then be presented to the TIC and included for publication by Stichting NMD as approved exception. The LCA practitioner is responsible for taking into account the longer turnaround time for the verification.

Transport phase (A4)
EN 15804 applies.

The transport phase (A4) starts when the construction product or element is ready for transport from the producer to the buyer, and ends when it is delivered to the construction site adjacent to the means of transport.

Note 1: Routes through any intermediate organisations should also be included, for example if there is a trader or processor between the producer and the construction site.

Building and installation process / construction (A5)
EN 15804 applies.

These processes (A5) are included in the form of one or more scenarios.
Standard values for 'loss in the form of construction waste' are included in section 2.6.3.6.

Use phase (B1-5)
B1 - The use of the construction product (life cycle phase B1) concerns the application in the Netherlands.
B2 - The maintenance (life cycle phase B2) concerns only material-related maintenance and not structure-related or location-related maintenance. Cleaning maintenance is only included if functionally important.
B3 - Repair (life cycle phase B3) concerns the predictable repairs that can be calculated in the form of a scenario.
B4 - Replacement of the entire product is defined in the calculation rules at building level by the addition of extra product cards. Replacement of the entire product will, therefore, not be reported separately in the use phase. Replacement of parts that cannot match the service life of the entire product are included here.

Example 1: *an air treatment cabinet with a service life of 25 years needs a replacement ventilator after 15 years. This replacement is declared under B4 of the product card. The replacement of the entire installation in relation to a reference service life of the building of 50 years is calculated in the calculation software's calculation rules and forms no part of B4 of the product card.*

B5 - Renovation (life cycle phase B5) is not part of this Assessment Method.
For energy consumption during use (life cycle phase B6) and water consumption during use (life cycle phase B7) see chapter 3.

Demolition and processing phase (C1-4)
C1 - the demolition phase, which starts when the structure is no longer in use and ends when the structure has been demolished or dismantled. This phase, therefore, comprises the activities at the demolition location.

Note 2: It is also possible that a building is reused or partly reused or that parts remain for use in a new application. Any dismantling activities are then modelled in the demolition phase. Any activities for reuse are modelled in the processing phase.

Example 1 *An example of partial reuse of a structure is a sand bed from a road that is reused for the reconstruction of the road. In this example no demolition works take place to the sand bed. Any recompaction of the sand bed falls under the processing phase and is modelled according to the allocation procedure in section 2.6.4.3.*

For the end-of-waste phase, the system boundary is determined in accordance with Appendix IV.

If a material, product or element is left without fulfilling a further function ('left without function'), it is treated as waste.

C2 - EN 15804 applies.
Standard values for the transport distances to the sorting locations, landfill locations and waste incineration plants (WIPs) are included in section 2.6.3.6.

C3 - EN 15804 applies.

C4 - EN 15804 applies.
For landfill processes, an end point of 100 years after landfill is assumed (see also 2.6.3.6 under generic data).

Module D - EN 15804 applies.
Section 2.6.4.3 describes how the net impact of module D must be calculated.

C3, C4 and module D - The environmental impact is calculated via the end-of-life processing scenarios as published on the National Environmental Database website. Further guidance on this is given in 2.6.4.3.

In derogation from this, Module D includes the avoided energy as described in 'Incineration in a waste incineration plant' in 2.6.3.6.

Raw material equivalent

The raw material equivalent(s) must be determined to calculate the correct benefits and impact in module D. The raw material equivalent indicates how much and which primary production process (in module A1-3 of another product system) can save a secondary material or secondary fuel because it is considered technically equivalent.
The raw material equivalent should be determined (within the defined product system) for each individual/ unique flow of:

- *Secondary materials as input flows in the product phase (Module A).*
- *Secondary fuel as input flow in the product phase (Module A).*
- *Products for reuse as output flows in the processing phase (Module C).*
- *Materials for recycling as output flows in the processing phase (Module C).*
- *Materials for energy recovery as output flows in the processing phase (Module C).*

Further guidance on this and examples are given in 2.6.4.3.

The raw material equivalent, as a representative substitution process for Module D, should be substantiated for these above flows with the standard data quality control and representativeness check.

For exported energy, no specific choice and justification of the raw material equivalent needs to be given. This output flow should be included according to the method described in 'Incineration in a waste incineration plant' in 2.6.3.6.

In the case of products for reuse as output flows in the processing phase, as mentioned above, the representative substitution at product level is expressed in a quality factor K. This quality factor is a measure of a product's remaining quality (not the material flows) compared to the initial product. The quality factor, K, is expressed in a % between 1 and 100 and can be determined by the producer through:

1. Substantiating technical quality following initial use; or
2. Anticipated residual service life of the 2nd use; or
3. Market value of the product for reuse in relation to the market value of the new product.

The above options are in order of preference for determining K.

The quality factor K becomes part of the end-of-life processing scenario of the relevant product and is expressed as follows;

vew (%) = percentage reuse from end-of-life processing scenario
mbD = environmental benefits outside product system
mlD = environmental impact outside product system

The factor K only applies to the benefits (not the impact) outside the product system; after all, it concerns the representative substitution at product level. The necessary additions in process, material, etc. that are required must be declared as environmental impact in D, of course for the full 100%.

Factor K is part of the end-of-life processing scenario for the reuse component; the other material flows are processed further in accordance with this Assessment Method's standard requirements.

Assumptions about future reuse must be based on substantiated data, as prescribed in the LCA standards included in section 2.2 of this Assessment Method, and not on intentions. Restraint should be exercised with regard to forms of reuse that cannot yet be demonstrated in practice. The reuse component or factor K is part of the verified file and must, of course, also comply with all generic requirements from this Assessment Method.

If desired, several product scenarios can be considered, as included in section 2.6.3.9. A product card can be produced for a reused product if desired.

Example 1: *1 m^2 masonry dry stacked; the producer has demonstrably substantiated that the quality of individual bricks is comparable after initial use but that 15% of individual bricks are rejected during reuse due to damage and are further modelled as waste or as recycling flow. The quality factor K for this product is 100% as the quality is, after all, the same. However, losses from rejection must be accounted for in module D. In this case (85% × K=) 85% net of product reuse can be calculated in the end-of-life processing scenario for this product.*

Example 2: *1 aluminium exterior door frame; the supplier offers both new and used frames from a similar series with a market value difference of 40%. The quality factor K for this product is 60%. In the case of a reuse percentage* of 50%, the net reuse percentage becomes 50% × K = 30%.*

Example 2a: *If the producer has a refurbishment programme that reduces the market value difference to 5% through repair and/or other processes, the quality factor K is 95%. However, the additional materials and processes that are added to the product must be fully declared as impact in module D. The net reuse percentage can be calculated here as 50% (reuse percentage) x K = 47.5%*

**The remaining part will be modelled as waste or recycling flow*

Example 3: *1 m² interior wall; a product-as-a-service programme for interior walls was established by the supplier. For the use of 1m2 of interior wall, the producer used market figures to demonstrate that on average 40% of interior walls are reused in projects in this programme. As the interior walls can be reused up to three times with adaptations, the actual use is four times, including initial use. The quality therefore decreases by 25% per cycle (from 100 to 0). The reuse percentage is an average of the number of times the product is reused.*

Module A - 40% of production is reuse, of which only additional transport is allocated to A1-A3.
Module D – quality factor K is ((1×75%)+(1×50%)+(1×25%)) ÷ 4 = 37.5%
Module D - the adaptations required for reuse are included as environmental impact in Module D, weighted equally to quality factor K. The remaining part will be modelled as waste or recycling flow.

This has enabled the development of a scenario for a product card for a wall as a service from this supplier. Of course, an explanation of the scope in service life of the concept is part of the product card; in this example this would be 4 times 25 years.

Example 4: *1 steel doorway with a span of 15 metres can be reused after its end of life. The doorway then needs a new coating, and 11% new material is needed. The K factor amounts to 89% based on the new material that needs to be added for the new desired quality or functionality. Of the adaptations required for reuse, the application of the new coating must be included as environmental impact in module D. The foundation will not be reused in this example. No quality factor K then needs to be determined; after all, reuse is already 0% in the end-of-life processing scenario.*

2.6.3.6. Criteria for omitting input and output

EN 15804 applies.

Production, delivery, removal, maintenance and end-of-life processing of capital goods are included. Infrastructure and capital goods are included in Ecoinvent 3.6 - allocation, cut-off by classification data, which is used as standard database. Ecoinvent 3.6 data are also used including infrastructure and capital goods.
If the contribution of capital goods to each individual environmental impact category of the production phase module (A1-A3) is less than 5%, provided this is substantiated, this may be disregarded.

In addition to EN 15804, an input that contributes less than 1% of the primary energy consumption and less than 1% of the total mass of the process in question, and for this reason could be omitted, should be included if it is expected to contribute more than an estimated 5% to one of the environmental impacts of the construction product per module, for example per module A1-A3, A4-A5, B1-B5, C3-C4 and D. As an additional requirement, the sum of environmental impact per module not taken into account in this way may not exceed 5% of the total per environmental impact category across the entire life cycle.

2.6.3.7. Selection of data

The following requirements apply in addition to EN 15804.

Representativeness of the processes from the manufacturer

Individual production locations must derive their data from that location.
If in the case of horizontal aggregation in the product system all production locations supply data, the result is automatically representative of the relevant group. If not all production locations from the group provide data, a representative cross-section should be made from the group of production locations, as far as they produce for the Dutch market, with regard to geographical and technical differences that may lead to differences in environmental impact.

Note 1: Whether this is the case can be determined by identifying the data that most influence the environmental impact, and the geographical and technological aspects involved.

Note 2: Horizontal aggregation can take place both at a producer's different product locations as well as at groups of producers or sectors that produce an environmental declaration.

If the producer is unwilling or unable to obtain representative production locations, but relies on random locations, the data will no longer be valid for the producer, but for the producer's relevant production location(s).

To determine the percentage, the average composition is based on the entire production's annual or multi-annual figures, weighted, according to production quantities, where applicable[3]. Instead of the average composition, a composition covering more than 80% of the production quantity in the year of study or a specific composition may also be chosen. Such a choice must be transparent.

Example 1: *A material that contains component Y is produced in 3 charges per year. Charge 1 delivers 10 kg of the material with 0.02 kg Y/kg; charge 2 delivers 15 kg with 0.1 kg Y/kg; charge 3 delivers 5 kg with 0.08 kg Y/kg. The ratio in production quantities of the charges is therefore: 10:15:5 = 2:3:1 or: 2 (33 %): 3 (50 %): 1 (17 %): The average percentage Y then amounts to: 0.33 × 0.02 + 0.5 × 0.1 + 0.17 × 0.08 = 0.07 kg Y/kg.*

Representativeness of other data

The other processes in the product system must give a representative or typical picture of the current geographical and technological situation. The area of application to which this norm applies is the Netherlands. 'Representative' means that data accurately reflect the real population. 'Typical' means that the data describe a certain, common situation (also called modal).

Note 3: The requirements for representativeness apply to all economic flows, including the service life used to determine the number of replacements, the percentages of primary and secondary material used or the end-of-life processing scenario.

If an existing EPD is used to draw up an EPD for a raw material, the representativeness of that EPD for this specific raw material must be demonstrated. If the EPD has been produced according to the Assessment Method and has been assessed according to the NMD Verification protocol, the underlying data, which is often not publicly accessible, does not need to be further analysed.

[3] *Or production volume if that is a common unit.*

Generic data

In addition to EN 15804, for the production of raw materials it is preferable to use data from the producer's own supplier. If it can be demonstrated that the supplier has no data available or does not want to make these data available, generic data can be used.

For generic data, in principle the process database based on the Ecoinvent 3.6 'allocation, cut-off by classification' database will be used. Long-term (>100 years) emissions, modelled separately within Ecoinvent, particularly for leaching, are not included. The cut-off after 100 years applies to all modules A-D and to all data, both generic and specific.

When using generic data for processes that process secondary raw materials or co-products, or when applying generic data from waste treatment processes, it should be checked as part of the data quality control that the system boundaries and any allocation method of the processes used are in accordance with EN 15804 requirements.

Standard values

The following standard values apply:

- transport distance single journey to the construction site if the construction product is produced in the Netherlands: for bulk material 50 km, for other materials, products and elements 150 km; for civil engineering structures the transport distance per structure is offset in the calculation tool;
- location to determine transport distance of materials from abroad to and from the construction site or customer: Utrecht;
  Note 4: If a material comes from abroad and the average distance to the Dutch market is not known, the distance between the production location and Utrecht is used.
- end-of-life processing scenario in accordance with the table on *www.milieudatabase.nl*;
- transport distance single journey from the demolition location to the sorting and/or crushing plant: 50 km;
- transport distance single journey for transporting soil: 50 km;
- transport distance single journey from the demolition or sorting location to the landfill location: 50 km;
- transport distance single journey of combustible material from the demolition or sorting location to the waste incineration plant (WIP): 100 km.

If specific data for transport distances are available, it is possible to deviate from the standard values.

The starting point for front-end transport processes in the case of LCAs for completed construction works is that one uniform choice should be made within the entire LCA. The choice should be generic (all distances for delivery and removal to the construction works are generic) or specific (all distances for delivery and removal to the construction works are specific); a mix is not permitted.

Return transport processes should be included in the calculation unless it can be demonstrated that this involves return loads. The inclusion of return loads is achieved by calculating the one-way trip and the average load factor as applied by Ecoinvent. This load factor is already incorporated in the Ecoinvent transport processes. The load factor is for large trucks (load capacity '>32t'), which account for approximately 60% of the process 'Transport, freight, truck, unspecified {GLO}| market group for transport, freight, truck, unspecified | Cut-off, U,' 50%; this corresponds effectively with outward journey full and return journey empty.

If it is demonstrated that the return journeys involve return loads, half the single journey distance can be used, but the result must be increased by 25% as a fully loaded truck consumes approximately 25% more fuel than an empty one. This basically means that the distance used to calculate demonstrable return loads is 62.5% (0.5 x 1.25) of the one-way distance.

For the removal of demolition debris and for the removal of soil, the means of transport is: 'Transport, freight, truck, unspecified {GLO}| market group for transport, freight, truck, unspecified | Cut-off, U' (Ecoinvent 3.6).

Within the Assessment Method the following processes from the process database are used:

- Diesel, low-sulphur {RER}| market group for | Cut-off, U [Ecoinvent 3.6]
  This process describes diesel production from raw materials, not the combustion of this.
- Natural gas, high pressure {NL}| market for | Cut-off, U [Ecoinvent 3.6]
  This process describes gas extraction and production, not the combustion of this.
- For energy from natural gas the following is used 'Heat, district or industrial, natural gas {Europe without Switzerland} heat production, natural gas, at industrial furnace >100kW | Cut-off, U' (process in MJ) [Ecoinvent 3.6]. An energy value of 31.65 MJ/Nm3 is used.[4]
- Diesel, burned in building machine {GLO}| processing | Cut-off, U [Ecoinvent 3.6]
  This process describes diesel consumption (production of diesel and combustion emissions).
- Electricity, low voltage {NL}| market for | Cut-off, U [Ecoinvent 3.6]
  This process describes electrical energy use (230-400 V) including production from raw materials and distribution (grid and transformer losses).
- Transport, freight, truck, unspecified {GLO}| market group for transport, freight, truck, unspecified | Cut-off, U [Ecoinvent 3.6] [Ecoinvent 3.6]
  This process describes transport of 1 tonne of freight per truck over 1 km (including return journey), including diesel production and consumption.
- Transport, freight, inland waterways, barge {GLO}| market group for transport, freight, inland waterways, barge | Cut-off, U [Ecoinvent 3.6]
  This process describes transport of 1 tonne of freight per inland vessel over 1 km, including fuel production and consumption.
- Transport, freight, sea, bulk carrier for dry goods {GLO}| market for transport, freight, sea, bulk carrier for dry goods | Cut-off, U [Ecoinvent 3.6]
  This process describes transport of 1 tonne of freight per bulk carrier over 1 km, including fuel production and consumption. If this process is chosen, proper justification is necessary. If in doubt, the process for a container ship should be used.
- Transport, freight, sea, container ship {GLO}| market for transport, freight, sea, container ship | Cut-off, U [Ecoinvent 3.6]
  This process describes transport of 1 tonne of freight per container ship over 1 km, including fuel production and consumption.
- For other background processes not mentioned here, an LCA practitioner will make the most appropriate choice or will make a choice in line with Ecoinvent 3.6.

[4] *A deliberate choice was made not to use a 'market' process as that database process involves a combination of 'industrial furnace' and 'co-generation', and in principle co-generation does not play a role in industrial processes. The standard energy value is based on the 'Dutch list of energy carriers and standard CO2 emission factors, version January 2018' (Netherlands Enterprise Agency). This value may not be adjusted for the use of Dutch natural gas. In the case of foreign natural gas, an appropriate specific value should be sought from literature.*

Loss in the form of construction waste

Some of the materials will be lost in the supply, storage and construction process itself. This waste has a relevant impact on the material flows. The loss depends heavily on the application, the construction site and how carefully the materials are handled. This Assessment Method uses several standard calculation rules for the release of construction waste. If it is desirable to deviate from these standard values, this is possible provided the research results include numerical substantiation.

Prefab products
Prefab products are manufactured in series and under controlled conditions. Waste is often immediately re-entered into the process. It is assumed that 3% of the materials will be lost (at the construction site or during transport).

In-situ products
Products must be made to fit at the construction site (e.g. bricks). This generally creates more waste. Moreover, part of the materials is lost through damage or weather conditions. It is assumed that 5% of the materials will be lost.

Auxiliary and finishing materials
Auxiliary and finishing materials, such as sealants, adhesives and paints, often leave residues that become unusable after a while. A lot of material also often remains on the packaging or on the tools used to apply the materials. It is assumed that 15% of the materials will be lost.

Incineration in a waste incineration plant (WIP)

In the case of incineration in a waste incineration plant (WIP) in module C, the avoided energy production can be offset in module D from the amount of net exported energy (MJ per energy carrier). This information is included in module D. Section 2.6.4.3 describes how the net impact of this avoided impact must be calculated in module D. In the case of incineration in module A1-A3, the avoided emission should not be declared in module D but in module A1-A3.

The following is used as average net efficiency of the Dutch waste incineration plants (WIP)[5]: 18% electrical and 31% thermal (Ecoinvent waste incineration processes do mention incineration values, but do not include avoided production; the efficiencies mentioned deviate from the Dutch ones). The waste-to-energy plant (AEC) must meet EU efficiency requirements for the avoided energy production to be calculated.

- When incinerating waste based on fossil raw materials:
  - For saved electricity: 'Electricity, high voltage {NL}| heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical | Cut-off, U'
  - For saved heat: 'Heat, district or industrial, natural gas {Europe without Switzerland} heat production, natural gas, at industrial furnace >100kW | Cut-off, U'
- When incinerating waste based on renewable raw materials:
  - For saved electricity: 'Electricity, high voltage {NL}| heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014 | Cut-off, U'
  - For saved heat: 'Heat, district or industrial, other than natural gas {NL}| heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014 | Cut-off, U'
- Settlement takes place on the basis of the Lower Heating Values (LHV) provided by Ecoinvent in the process descriptions. Several LHVs are included below:

[5] *Written announcement based on the annual verification of the R1 status for 2016 [RWS-WVL 2018]*

Table 1: generic LHVs

	LHV (MJ/kg)
based on fossil raw materials	
PET	22.95
HDPE	42.47
LDPE	42.47
PP	32.78
EPS	32.20
ABS PVC	35.20 21.51
based on renewable raw materials	
Carton	15.92
Wood	13.99
Cotton	14.45
Paper	14.11

The LHVs included here are generic and conservative. If specific data from specific streams are available within the scope and context of the LCA study, these can be used.

2.6.3.8. Data quality

EN 15804 applies.

The following passage from [A2:2019 6.3.8.2] comes into effect when that system is available: 'the documentation format and data sets for the LC inventory data used in the LCA modelling shall use the current ILCD format and nomenclature as defined in the document, "International Reference Life Cycle Data System (ILCD) Handbook - Nomenclature and other conventions".'

If the aforementioned ILCD format has not yet been followed, the following applies:
In addition to EN 15804, data quality must be assessed using a data quality system developed for three categories:

- unit processes (see NMD Verification protocol July 2020, Appendix D)
- horizontal aggregated processes (see NMD Verification protocol July 2020, Appendix D)
- vertical aggregated processes (see NMD Verification protocol July 2020, Appendix D)

2.6.3.9. Development of product scenarios

EN 15804 applies.

As an exception to the timeliness rule, a future scenario may be assumed for the end-of-life processing scenario if the strictness clause that there will be a demonstrable working (return) system at the time of the end-of-life processing is complied with. The plausibility of this is an explicit part of the file verification.

'Working' means that:

- the collection structure has been provided for economically and logistically;
- the economic preconditions are stimulating;
- the efficiency of the system or return system serves as starting point;
- the technical infrastructure for the recycling process is available and it may be assumed that the required capacity will follow the market;
- the application in which the recycled material is included is known or it can be assumed that there is a sufficient market.

Example 1: *In using new hydraulic engineering blocks, it can be assumed that there is sufficient market for reuse, as product reuse is common in this application.*

Example 2: *A return system that has been declared generally binding can be used as a scenario.*

For waste, specific end-of-life processing scenarios have been developed per basic profile. If no specific value is available, standard values are given in the table on *www.milieudatabase.nl*

If multiple installation options are available for a product (or functional unit) that have an impact on the end-of-life phase and/or the options for reuse, recovery or recycling, multiple environmental profiles (C1-C4, D) can be provided. The following preconditions apply here:

- the product delivered is in fact suitable for the application;
- additional resources and/or substances are declared in the relevant module D;
- specific design conditions that apply are clearly described;
- end-of-life processing scenarios are up-to-date with the same exception applying as described previously.

2.6.3.10. Units

EN 15804 applies.

2.6.4. Life cycle inventory

2.6.4.1. Data collection

In addition to EN 15804, requirements have been set on data precision.
For the processes carried out at the construction product producer, the energy balance will have to be determined at company level and deviations will have to be corrected to an accuracy of ≥ 95%.

For the processes carried out at the construction product producer the mass balance per process used will have to be determined (if different from the data at company level) and deviations will have to be corrected to an accuracy of ≥ 95%. The mass balance concerns the actual consumed amounts per process. The validity of the remaining processes needs to be checked by determining the mass balance per process and correcting deviations to an accuracy of ≥ 95%. See 2.6.3.5. for omitting data.

In addition to EN 15804, suppliers are first approached for their own (front-end) data before using generic data if necessary; specific data always take precedence over generic data.

In addition to EN 15804, for a large number of standard processes Ecoinvent 3.6 is prescribed as a data source. This indicates which environmental interventions should at least be considered, how sum parameters should be handled and how biogenic carbon dioxide should be handled.

The preferred order for determining emissions is:

1. methods designated in laws, decrees or ministerial regulations;
2. methods from standard sheets;
3. methods that are described in (possibly sector specific) private law agreements.

The following interventions must have a value:
emissions to air when using thermal energy of CO_2, CO, NO_x, SO_2, C_xH_y and particulates (PM10: particulates < 10 µm);

- emissions to water of COD, BOD, P-total, N-total and solid matter (PM10: particulates < 10 µm); emission to the soil of PAHs and heavy metals;
- other emissions for which environmental regulations impose requirements on the producer of the construction material, product or element.

The name must be such that this creates the least possible likelihood of misunderstanding. The name must indicate what has actually been determined. If available, an index name from the CAS registration system should be used, unless this name does not match the name in the list of environmental interventions from the latest CML-NMD method, available from Stichting NMD.

Data not from the producer

Those supplying to and purchasing from the relevant construction product's production locations must be asked to make data available about the production process in accordance with the requirements set by this standard.

Note 1: Data from producers (primary source) can be provided in the form of process data, in the form of a cradle-to-gate LCI or in the form of an environmental profile. The representativeness for use in the Netherlands must be established. This motivation is an explicit part of the file verification.

If a supplier or purchaser provides no or insufficient data, public sources, industry figures and literature data will be used.

Note 2: Conversions or estimates may be necessary when using public sources and literature. This should preferably be done by an expert in the relevant field ('expert guess').

Common public sources and literature sources should be used, i.e. those most widely accepted by LCA practitioners.

If processes are available from different regions, the following order of priority will be used:

1) the relevant country;
2) a comparable neighbouring country;
3) the relevant region (for example Northwest Europe);
4) the relevant continent or sub-continent;
5) the world.

Example 1: *Suppose that the database contains standard values of three electricity processes: one based on the Dutch fuel mix, one based on the German mix and one as a European average. For a process that takes place in the Netherlands, the Dutch mix should be selected. For a process that takes place in Spain, the European mix should be selected.*

If there is any doubt about the representativeness of the data, the worst case data should be used.
The plausibility of the used data is an explicit part of the file verification.

Example 2: *If a producer uses generic data from the NMD for a certain raw material and there are doubts about whether this raw material falls within the range of product data in the NMD and generic data are also available in Ecoinvent 3.6 for the same raw material, which leads to a higher environmental impact, he may only use the NMD data if he demonstrates that it is more representative for his raw material.*

Completeness of individual environmental interventions

All environmental interventions from the most recent CML-NMD method that are available via *www.milieudatabase.nl* and those of the International Reference Life Cycle Data System (ILCD) Handbook ('identified by the name EN_15804'), must be considered. The interventions will then be awarded a value unless the value is unknown. This creates the following three parts:

a) a positive or negative value;

b) the value 0 (for all interventions of which the value is below the detection limit);

Note 3: Values may both be measured and rationalised at 0.

c) a question mark (if it is not known whether the intervention takes place).

In the case of a question mark, it must be determined whether the environmental intervention can reasonably occur at a level that can influence the results of the LCA. An estimate of the value will need to be made if an environmental intervention can potentially contribute more than 5% cumulatively over the functional unit.

Completeness of sum parameters

Where available in the producer's data, sum parameters (such as NO_x, C_xH_y, COD, BOD, P-total, N-total, PAH and heavy metals) should be broken down into individual components for characterisation. The standard list contains several sum parameters for which characterisation factors are also available. The intervention value of the sum parameters can be entered in two ways:

The intervention value of the sum parameter is known. This is entered.

a) One or more individual substances are known, but only a characteristic factor is available for the sum parameter. A sum parameter is a representative value for the sum of a group of substances for a particular impact, for example PAHs. The other substances' intervention values are then entered into the sum parameter pro rata. When data are available for several substances from the sum parameter, the sum parameter will be calculated for each substance and the results averaged.

Note 4: Emissions of substance groups may be translated into individual substance emissions by using relative proportions of (characterised) total emissions within a group as indicated in the normalisation report Oers et al. (2001).

2.6.4.2. Calculation procedures

EN 15804 applies.

2.6.4.3. Allocation of input flows and output emissions

EN 15804 applies.

Section 6.4.3.3 of EN 15804 prescribes how the net impact of module D must be calculated. For readability purposes, we have chosen to present the relevant text below in a different form than the original:

Calculation of net output flows of secondary materials or fuel:

Add up:	All output flows of a secondary material or fuel (as *'materials for recycling', 'materials for energy recovery' or 'exported energy'*).
Subtract:	All input flows of this same secondary material or fuel (as *'secondary material use', 'renewable secondary fuel use' or 'non-renewable secondary fuel use'*).

Do this: First per sub-module (for example B1-B5, C1-C4, etc.), then for the modules (for example B, C) and finally for the total product system, which will ensure that you arrive at the net output flow of the product system.

Example 1a:
Rebars are processed at the end of a building's service life in accordance with the standard scenario (see *www.milieudatabase.nl*). The standard scenario shows that 5% of rebars is lost through disposal and 95% is recycled. In the case of rebars it can be assumed that 100% of the steel that is recycled also actually reaches end-of-waste status after processing. Therefore, for each kg of steel processed, 0.95 kg of steel scrap (95% x 100% x 1 kg) leaves the current system as material for recycling (and therefore becomes available as secondary material for a subsequent system). Suppose the data inventory shows that 25% of the rebars actually used in the building was produced from steel scrap. For every 1 kg of steel, 0.25 kg (25% x 1 kg) of steel scrap therefore entered the current system as secondary material.
The net output flow in this product system is therefore 0.7 kg (0.95 kg - 0.25 kg) of steel scrap.

Calculating substitution effects when using secondary material or fuel:

Add up: All environmental impact related to the recycling and/or treatment process (at the end of the waste phase) across the entire material flow up to the moment of functional equivalence, where the secondary material or energy saves primary production.

Subtract: All environmental impact related to the production of the material or energy that is saved (net flow) from primary sources.

Apply: A justified/substantiated *'value-adjusted factor'* that represents the difference between the differences in functional equivalence when the output flows do not reach the functional equivalence of the primary production that is saved.

Example 1b:
In line with example 1a, benefits can be calculated for the module D product system for the net output of 0.7 kg of steel scrap as material for recycling. Steel scrap, once it has reached end-of-waste status, can be used almost immediately in a new production process. The steel scrap only has to be transported to a production location for it to directly replace raw iron (step: add together). In this example, transporting 0.7 kg of steel scrap to any production location saves 0.7 kg of raw iron from primary sources (step: subtract). In this example, there is functional equivalence, so no value-adjusted factor needs to be applied.

- Please note: It is important to carefully examine the *material for recycling* that is forwarded in relation to the selected primary process that is saved. In this example, the transport of steel scrap to the production location was consciously included in the calculation, as the transport of primary raw materials is also part of the saved primary process.

Declaration module D

As stated above, for correct declaration of module D credits, EN 15804 must expressly be followed.
The substantiation of the following aspects is of key importance here:

1. A mass balance must be formulated, derived from the LCI, that includes all the product system's individual secondary input flows *(Secondary materials, Secondary fuel)* and all individual secondary output flows *(Products for reuse, Materials for recycling, Materials for energy recovery and exported energy)*.
   a. The *secondary* input flows are important as these enter the product system free from environmental impact, while module D credits have been declared for this in a previous product system.
   b. The *secondary* output flows are important because they become available in a subsequent product system. Environmental benefits for these output flows can be declared in module D.
2. The raw material equivalent must be determined quantitatively and qualitatively for all these secondary input and output flows. The *raw material equivalent* (see also 2.6.3.4.) indicates how much and which primary production process (input module A, which can also contain secondary raw materials) can replace the relevant secondary flow as they are technically equivalent. The *raw material equivalent* (see also 2.6.3.4.) will be used to calculate any benefits or impact in module D.

3. Any waste flows from the recycling process as a consequence of degradation or efficiency of the recycling process must also be included.
4. Module D is calculated using the sum of the net output of the individual *secondary raw material* flows.
   a. If the net output is negative, this will result in an increased environmental impact in module D (outside the system boundaries).
      N.B.: a loss of secondary raw materials can only be replenished from a primary system;
   b. If the net output is positive, this will result in a reduced environmental impact in module D (outside the system boundaries).

Verified environmental profiles, for which inclusion in the process database is desirable, must be provided with all relevant information regarding representativeness, use of secondary raw materials and system boundaries in relation to the waste treatment phase and any raw material equivalent as used in Module D credits.
Several examples of how the above rules are applied are given below.

Example 1	A steel construction profile that is produced from 100% secondary iron where 95% of the iron becomes available again as material for recycling in a new product system at the end of its technical service life causes a **net** loss of secondary raw materials. In Module D, this net loss must be compensated as impact based on the impact of the primary obtained iron.
Example 2	Concrete granulate used as a substitute for coarse aggregates in concrete has a different fractional distribution than the fractions that become available as material for recycling during traditional concrete debris crushing. In calculating Module D, these different flows should be considered as separate fractions, each with its own raw material equivalent.
Example 3	When using mixed granulate (secondary material) in a road foundation, the limited fraction of unhydrated cement present in the mixed granulate contributes to the foundation's binding and load-bearing properties. When the materials become available again at the end of the foundation's service life, they will have lost this hydraulic property. What remains is an output flow with another quality. In calculating Module D, these different flows should be considered as separate fractions, each with its own raw material equivalent.
Example 4	The difference between *exported energy and materials for energy recovery* only relates to whether combustion, and energy recovery, takes place in the current product system or in a subsequent product system. This should therefore be considered in establishing the raw material equivalent when determining the representative substitution process. If wood, as *material for energy recovery,* becomes available in a subsequent product system as secondary fuel, then this wood is technically equivalent to primary wood that is used as fuel. If exported energy from wood waste burnt in a WIP becomes available in a subsequent product system, then this energy is technically equivalent to that of primary wood burnt in a biomass power plant / wood gasifier for the production of electricity and/or heat This starting point is also used to determine the standard values for incineration in a WIP (2.6.3.6).
Example 5	Glass wool insulation is produced for approximately 80% from recycled glass. It is clear from the standard waste scenarios that around 85% of glass wool is disposed of at the end of its service life. This also causes a **net** loss of secondary raw materials within the product system. In Module D, this net loss must be compensated as impact based on the impact of the primary produced glass.

Module D specifically includes the benefits and impact of an examined product outside the system boundaries. Reuse of products and/or construction elements outside the scope of the LCA study, for example due to earlier dismantling, is not part of this LCA study and therefore also not part of module D.

Secondary raw material use quality of

Within a product system, nothing can be said about the material use quality of materials released for recycling at the end of the service life (as secondary raw materials) but we can say something about the quality of this flow (raw material equivalent). Chapter 2 applies in full when producing an environmental profile for construction elements/installations that are to be reused in their entirety.

More or less materials are released for recycling depending on the specific end-of-life processing scenario and the recycling process efficiency. This has a direct impact on the module D credits that are awarded to the product system. All rules from 2.6.4.1. apply here.

The impact of the quality of the application in which secondary raw materials are used results from a comparison of different product systems. The alternative solutions that are available to meet a specific functional unit are important here.

This is illustrated using one example: asphalt. This example also clarifies how important it is that a secondary material's raw material equivalent is substantiated properly and in the right way. For example, asphalt crushed into asphalt granulate can be used in two ways, (1) again in asphalt or (2) in a road foundation as asphalt granulate cement. Reusing this again in asphalt has the potential to avoid both crushed stone, sand and part of the bitumen fraction as primary product. Used in asphalt granulate cement, the asphalt granulate only replaces a primary extracted crushed stone or gravel fraction as filling material. This means that, in determining the raw material equivalent the inherent properties and exact composition of the secondary material and its use need to be examined carefully. All rules from 2.6.4.1. apply equally to this and form part of the verification of the file.

6.4.4, which was added to EN15804/A2:2019 on biogenic carbon, also 'automatically' enters into force via the Assessment Method as 'EN 15804 applies'.

2.6.5. Life cycle impact assessment

The objective of this Assessment Method version 01-07-2020 is to already implement the changes in chapter 2, in anticipation of the complete implementation of EN 15804/A2:2019 in the Assessment Method (including chapter 3). This working method enables the system to continue functioning based on EN 15804/A1:2013 ('set 1') while the environmental impact scores are already being determined according to A2:2019 ('set 2') as well. As soon as chapter 3 (including the weighting to the 1-point score) has been amended, data compiled according to this amendment can be used immediately.

EN 15804/A1:2013 is in force for set 1. EN 15804/A2:2019 is in force for set 2.

Set 1:
For set 1, in addition to EN 15804/A1:2013, the environmental impact categories human toxicological effects and ecotoxicological effects should also be calculated.
In addition to EN 15804/A1:2013, for set 1 it applies that the characterisation factors are all taken from the most recent version of the (CML-NMD), available as download via the Stichting NMD website *www.milieudatabase.nl*. This is more extensive than the list of characterisation factors from EN 15804 annex A1. The most recent set of characterisation factors for the environmental indicators and environmental effects is available as download from the Stichting NMD website *www.milieudatabase.nl*.

The environmental impact categories are:

- Depletion of abiotic raw materials, excl. fossil energy carriers
- Depletion of fossil energy carriers
- Global warming
- Ozone layer depletion
- Photochemical oxidant-formation (smog)
- Acidification
- Eutrophication
- Human toxicity potential
- Ecotoxicological effects, aquatic (freshwater)
- Ecotoxicological effects, aquatic (marine)
- Ecotoxicological effects, terrestrial

The above-mentioned set of characterisation factors includes an interpretation of the CMLIA method for characterising substance groups (within global warming, ozone layer depletion, photochemical oxidant formation, acidification and eutrophication). Guidelines have been included for several other practical matters that are important for the characterisation and are part of this Assessment Method for unambiguous characterisation and classification.

Set 2:

The standard set with environmental footprint characterisation factors is used for set 2 to which EN 15804/A2:2019 refers ('EF characterisation factors'). Both the core environmental impact indicators as well as additional environmental impact indicators should be determined.

The environmental impact categories are:

- Global warming - total
- Global warming - fossil
- Global warming - biogenic
- Global warming - land use and changes in land use
- Ozone layer depletion
- Acidification
- Freshwater eutrophication
- Marine eutrophication
- Terrestrial eutrophication
- Smog formation
- Depletion of abiotic raw materials, minerals and metals
- Depletion of abiotic raw materials, fossil fuels
- Water consumption
- Particulate emissions
- Ionising radiation
- Ecotoxicity (freshwater)
- Human toxicity, carcinogens
- Human toxicity, non-carcinogens
- Land use-related impact / soil quality

Calculations with set 1 and set 2:

1) The values of the environmental impact categories are calculated by allocating the environmental interventions from the inventory to the environmental impact categories;
2) multiplying the interventions per environmental impact category by the characterisation factors from the CML-NMD (set 1) and EN 15804/A2:2019 (set 2) method;
3) adding up the values obtained per environmental impact category.

The scores for the various environmental impact categories together form the environmental profile.

Non-characterised interventions

It should be verified that all environmental interventions have been characterised. If that is not the case, the following actions must be taken:

a) If the cause concerns a deviating name, correct the name so that the substance can be characterised as yet.
b) If the cause is a missing characterisation factor, this should be characterised according to a chemically and physically similar substance. If this is not available, include this in a list of non-characterised interventions, with an indication of the interventions of which an environmental impact can be expected.

Aggregation of environmental profiles

If the producer of a construction product has multiple production locations that provide data, the data must be averaged. This aggregation can be implemented at environmental intervention level or at environmental profile level.
An 'average' environmental profile of a process is obtained during aggregation of environmental profiles.
The average environmental profiles are calculated according to the weighted production quantity average[6] of the selected production locations. The production quantities may be estimated with respect to size.

2.6.6. Life cycle interpretation

2.6.6.1. Clarification of the results

Interpretation is an important element in an LCA report's quality control. This is covered in the ISO14044 (section 4.5 and Annex B) and EN15804+A2 (section 8.2) standards, but no specific interpretation is prescribed, which is why this is defined in the Assessment Method. During interpretation, it is important that the relationship between the inventory data and the impact assessment results is analysed in a way that makes the results understandable and plausible.
The following elements must at least be present in the interpretation chapter of the LCA report:

- provide an overview of the contributions of the various modules to each impact category (A1-A3 may remain aggregated if necessary). Discuss which modules have the highest contribution for the most relevant impact categories. Provide an explanation for this.
- provide an overview of ECI scores per module (A1-A3 may remain aggregated if necessary). Discuss which modules have the highest and lowest ECI scores. Provide an explanation for this.
- for the modules with the highest ECIs, indicate which raw materials, materials and/or processes have the most relevant contribution.

[6] *Or production volume if that is a common unit.*

- provide an overview of how the various impact categories contribute to the total ECI. This can be done per module, but can also be aggregated for the entire life cycle. Discuss which impact categories make the highest contribution. Provide an explanation for this.
- when module D is included in the LCA, discuss the relevance of this module's contribution to the total score and which material plays the biggest role in this.

2.6.6.2. Sensitivity analysis

A sensitivity analysis must be carried out for the most important choices and assumptions made and implemented in the LCA to ascertain the robustness of the LCA results. Choices and assumptions can relate to uncertainties in models, starting points and scenarios and uncertainties in the elaboration of the parameters within this. A sensitivity analysis must at least be carried out for (where applicable):

- the influence of geographical and technological distribution within a group of product locations. Use the highest and lowest values in the sensitivity analysis. Outliers may be removed from the data set if necessary; distribution < 20%;
- the distribution as a consequence of distribution in an average composition. Use the highest and lowest values in the sensitivity analysis. Outliers may be removed from the data set if necessary; distribution < 20%;
- the distribution due to averaging when establishing a group average. Use the highest and lowest values in the sensitivity analysis. Outliers may be removed from the data set if necessary; distribution < 20%;
- the distribution as a consequence of uncertainties in starting points within the allocation for recycling. If method 1) or 2) from 2.6.4.3 is used, use method 3) in a sensitivity analysis. If method 3) is used, conduct a sensitivity analysis for the distribution in values; distribution < 20%;
- allocation of multi-input and multi-output processes if not using the standard distribution key (mass basis for multi-output processes and physical composition for multi-input processes). The standard distribution key should then be used in the sensitivity analysis.

The LCA must be revised if the results of the sensitivity analysis give reason to do so. The differences may not amount to more than 20% on one of the environmental impacts compared with the average or original value. If the sensitivity analysis shows that the differences amount to more than 20%, a split must be made in separate environmental declarations in which the differences remain within the 20% limit. If it can be demonstrated that a worst case scenario is chosen in the LCA, the sensitivity analysis may be omitted.

1. The requested interpretation and sensitivity analyses in section 2.6.6 only need to be implemented based on the results obtained with set 1.

2.7. Content of the EPD (EN 15804 7 Content of the EPD)

The objective of this Assessment Method version 1.0 is to already implement the changes in chapter 2, in anticipation of the complete implementation of EN 15804/A2:2019 in the Assessment Method (including chapter 3). This working method enables the system to continue functioning based on EN 15804/A1:2013 ('set 1') while the environmental impact scores are already being determined according to A2:2019 ('set 2') as well. As soon as chapter 3 (including the weighting to the 1-point score) has been amended, data compiled according to this amendment can be used immediately.

For the EPD therefore, this means that the results of set 1 and set 2 should be included. See also 2.8.2.2.

2.7.1. Declaration of general information

EN 15804 applies.

In addition to EN 15804, only an internal independent verification is not permitted: the EPD must be verified by an independent third party.

2.7.2. Declaration of environmental indicators from the LCA

2.7.2.1. General

EN 15804 applies.

2.7.2.2. Regulations for declaring LCA information per module

EN 15804 applies.

2.7.2.3. Indicators that describe environmental impact (set 1)

EN 15804 applies.
In addition to EN 15804, the environmental impact categories should be presented as follows:

Table 2: Indicators that describe environmental impact (set 1)

Environmental impact category	Indicator	Unit
Abiotic Depletion Potential for non-fossil resources	ADPE	kg antimony
Abiotic Depletion Potential for fossil resources	ADPF [7]	kg antimony
Global Warming Potential	GWP	kg CO_2
Depletion potential of the stratospheric ozone layer	ODP	kg CFC 11
Formation potential of tropospheric ozone photochemical oxidants	POCP	kg ethylene
Acidification Potential of land and water	AP	kg SO_2
Eutrophication Potential	EP	kg $(PO_4)^{3-}$
Human Toxicity Potential	HTP	kg 1.4 dichlorobenzene
Fresh water aquatic ecotoxicity potential	FAETP	kg 1.4 dichlorobenzene
Marine aquatic ecotoxicity potential	MAETP	kg 1.4 dichlorobenzene
Terrestrial ecotoxicity potential	TETP	kg 1.4 dichlorobenzene

[7] *If 'depletion of fossil energy carriers' is available in the MJ unit, the conversion factor 4.81E-4 kg antimony/MJ can be used [CMLIA, Part 2b: Operational annex, page 52]*

Table 3: Indicators that describe environmental impact (set 2)

Environmental impact category	Indicator	Unit
Climate change - total	Global Warming Potential total (GWP total)	kg CO2-eq.
Climate change - fossil	Global Warming Potential fossil fuels (GWP fossil)	kg CO2-eq.
Climate change - biogenic	Global Warming Potential biogenic (GWP biogenic)	kg CO2-eq.
Climate change - land use and land use change	Global Warming Potential land use and land use change (GWP – luluc)	kg CO2-eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11-eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H+-eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP freshwater)	Kg P-eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP marine)	kg N-eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP terrestrial)	mol N-eq.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP)	kg NMVOC-eq.
Depletion of abiotic resources - minerals and metals	Abiotic depletion potential for non-fossil resources (ADP minerals & metals)	kg Sb-eq.
Depletion of abiotic resources – fossil fuels	Abiotic depletion for fossil resources potential (ADP fossil)	MJ, net cal. val.
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m3 world eq. deprived
Particulate Matter emissions	Potential incidence of disease due to PM emissions	Health problems - incidence
Ionizing radiation, human health	Potential human exposure efficiency relative to U235 (IRP)	kBq U235-eq.
Eco-toxicity (freshwater)	Potential Comparative Toxic Unit for ecosystems (ETP fw)	CTUe
Human toxicity, cancer effects	Potential Comparative Toxic Unit for humans (HTP-c)	CTUh
Human toxicity, non-cancer effects	Potential Comparative Toxic Unit for humans (HTP-nc)	CTUh
Land use-related impacts / Soil quality	Potential soil quality index (SQP)	Dimensionless

2.7.2.4. Indicators that describe raw material use

As well as the environmental impact categories from table 1, parameters for raw material use, waste generation, and material and energy release are also reported in accordance with EN 15804. For purposes of readability, these tables are presented here.

Table 4: Parameters that describe raw material use

Parameter	Unit
Use of renewable primary energy excluding renewable primary energy used as materials	MJ, net calorific value
Use of renewable primary energy used as materials	MJ, net calorific value
Total use of renewable primary energy (renewable primary energy and renewable primary energy used as materials)	MJ, net calorific value
Use of non-renewable primary energy excluding non-renewable energy used as materials	MJ, net calorific value
Use of non-renewable primary energy used as materials	MJ, net calorific value
Total use of non-renewable primary energy (non-renewable primary energy and non-renewable primary energy used as materials)	MJ, net calorific value
Use of secondary materials	kg
Use of renewable secondary fuels	MJ, net calorific value
Use of non-renewable secondary fuels	MJ, net calorific value
Net use of freshwater	m^3

Table 5: Other environmental information: waste categories

Parameter	Unit
Hazardous waste	kg
Non-hazardous waste	kg
Radioactive waste	kg

Waste is based on the 'EDIP2003 method' included in CML-NMD.

Table 6: Other environmental information: output flows

Parameter	Unit
Materials for reuse	kg
Materials for recycling	kg
Materials for energy	kg
Exported energy	MJ per energy carrier

2.7.2.5. Information on biogenic carbon content

EN 15804/A2:2019 applies.

2.7.3. Scenarios and additional technical information

EN 15804 applies.

2.7.4. Additional information on the emission of hazardous substances into indoor air, soil and water in the use phase

EN 15804 applies.

2.7.5. Aggregation of information modules

EN 15804 applies.

2.8. Project report (EN 15804 8 Project report)

2.8.1. General

EN 15804 applies.

The report must be produced in Dutch, German, French or English.

2.8.2. LCA elements from the project file

2.8.2.1. General

EN 15804 applies.

In addition to EN 15804, the following is added to the information for the LCI:

- a bill of materials (the names of substances do not need to be stated for the composition, but the structure of the construction product does);
- any additional function(s) that are not included in the functional unit and that relate to the use of the material, product or element in construction works;
- a description of how the composition of all construction products is determined in the bill of materials (e.g. via a definition of standards);
- a description of the process tree and the process tree demarcation, with substantiation;
- the adopted service life of the construction product, including a description and justification of the scenarios used;
- information that shows that the Assessment Method system boundaries have been followed, any deviations from this and why, and the impact this has on the end results;
- the data categories;
- the procedures for data collection (questionnaires, checklists. etc.);
- the calculation procedures (for example for estimates);
- which data originate from primary sources and which data from secondary sources;
- a substantiation of the choice made for generic data (National Environmental Database, Ecoinvent 3.6, other data);
- an acknowledgement of the source of the literature, including at least the title, author and year;
- if standard values are not used, a description of the conversion efficiency of energy sources, of how the extraction and transport of fuels is handled, of the combustion values of energy carriers, of the fuel mix in electricity generation, and of the distribution of the energy flow;
- a description of how the extent of completeness per data category is determined and how deviations have been handled;
- a list of process emissions relevant for the LCA study that are part of the environmental permit in accordance with the data quality requirements;
- a list of contracted suppliers in accordance with the data quality requirements;
- the way in which data have been validated;
- the outcomes of mass and energy balances, corrections and statements for deviations.

2.8.2.2. Product cards and scaling

The product cards contain the information that must be included in the National Environmental Database. The current format for supplying these is available on *www.milieudatabase.nl*.

The product cards contain general product information, such as composition, application, service life and any other performance. The product cards also contain all environmental profiles based on this Assessment Method.

In formulating the EPD the data owner can then choose whether or not to opt for scaling. The advantage of scaling is that it is not necessary to add a new product to the NMD for each dimension (e.g. thickness in the case of floors). Scaling is linked to the product component's set of environmental data (the 'Profile set'). For multiple product components, each Profile set can be scaled in its own way. For example, an HSB element with a scaled insulation layer, but non-scaled cladding. A set of environmental data (Profile set) must be entered for each product component. In some cases a product component may have multiple Profile sets.

For scaling, extra product information is needed in the NMD. The following steps are used to generate the right data:

1. Determine the scalable 'dimension'
   The form of the product or product component determines the way in which the scalable 'dimension' is determined for the scaling function. A choice can be made from four options:
   - Option 1: no scaling.
   - Option 2: scaling of product based on one dimension (thickness, width, length or height).
   - Option 3: scaling of product based on a rectangular surface (2 dimensions).
   - Option 4: scaling of product based on a circular surface (diameter).

2. Create table with product variants (measurement points)
   Per product component a table should be created in which the scalable dimensions and corresponding mass are plotted for several variants. The requested dimensions for determining the scalable dimensions depend on the choice made under 1.

Table 7: Example variants in a table

Option 1: scalable dimension is surface - rectangle				
Variants	width	height	scalable dimension	mass
Smallest	10.4	7.8	81	1.45
Smaller	12.7	9.4	119	4.23
Standard	14.0	11.4	160	5.88
Bigger	15.1	13.3	201	6.78
Biggest	16.6	14.3	237	7.44

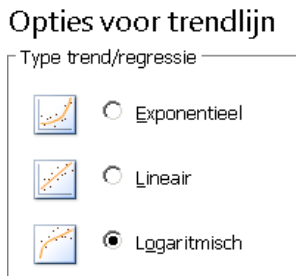
The number of variables depends on the extent of product variation during Scaling. We advise using at least three variables for a new or unknown product. These three variables must then describe the entire range of the product in the scope with a minimum, maximum and default/standard variant.

3. Select the most appropriate scaling function

   The most appropriate function is determined based on the values in the table. This can be done by plotting the values in a chart in Excel and selecting the most appropriate option from the various options for the trend line (appears after clicking on the trend line). A choice can be made from four options:

   - Option 1: product component has no scaling.
   - Option 2: product component has a linear scaling.
   - Option 3: product component has an exponential scaling.
   - Option 4: product component has a logarithmic scaling.

   In determining the most appropriate line, the R^2 score (charts option in Excel) can be used as an aid. The closer the R^2 score approaches 1.0, the better it is. For values lower than 0.9, the match is poor. Although no requirement has been set on the R^2 score, there is a requirement that the actual value may deviate by no more than 10% from the value calculated with the function.



For the function data entry in the NMD

- Constants:

  The function of the trend line is described in the diagram. Each function contains two constants. Copy these into the appropriate input fields in the Product Section.

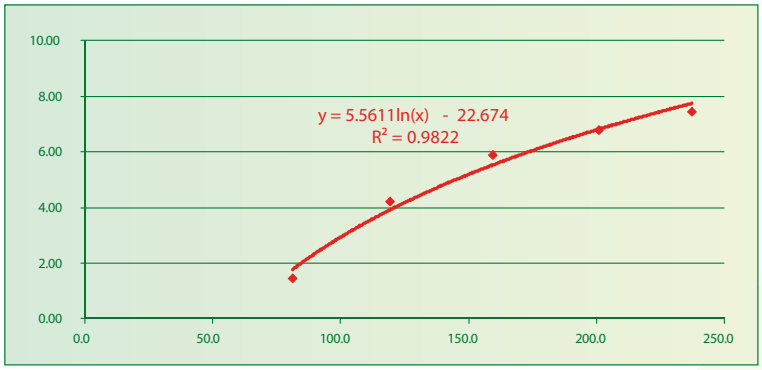
- Range:

  Indicate the range for which the function applies by specifying the lowest and highest value.

- Default values:

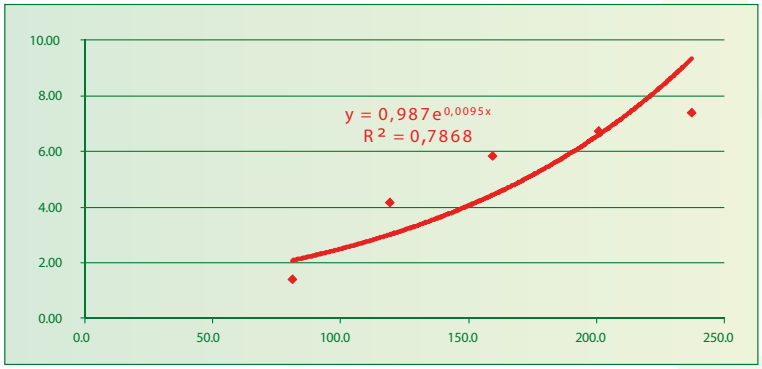
  Indicate the default dimensions (1 or 2 dimensions) on which the input is based. The user can change these default values in the calculation tools.

Example: determining the most appropriate function + determining C1 and C2

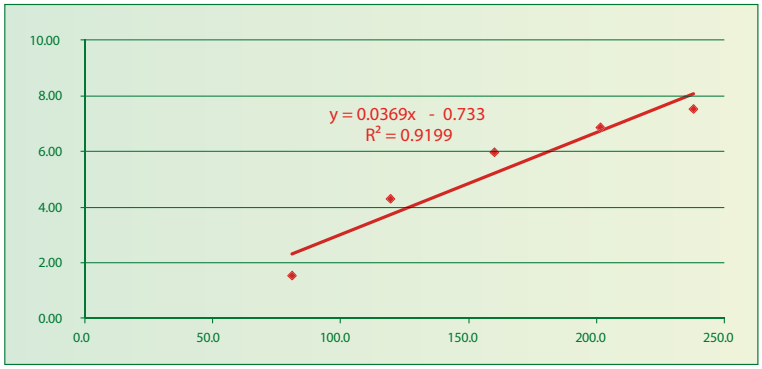


Formula	
Scalable dimension	159.6
Mass	5.56
C1	5.56
C2	-22.65
y = 5.5611 Ln(x) + -22.647	

Choice (highest value R2)



Formula	
Scalable dimension	159.6
Mass	4.50
C1	0.99
C2	0.0095
y = 0,987 EXP (0,0095 *x)	



Formula	
Scalable dimension	159.60
Mass	5.56
C1	0.037
C2	-0.73
y = 0.0369 Ln(x) + -0.733	

In principle, the steps described above should always be completed; with simple scaling the steps can also be completed quickly. With more experience of scaling and/or a known product, the steps do not all need to be explicitly defined. The scaling must, however, be traceable and therefore verifiable within the file.

PLEASE NOTE: the entered materialisation of a product card should always take place in accordance with the default value of the scaling dimension(s). For example: my product is scalable to length and has a default length of 1 m (= default). I then enter the product as being materialised as 1 m in length, so that the environmental impact represents 1 m of product.

2.8.2.3. Comparison of products for optimisation

The products in the NMD have been assigned a unit in line with how they are traded on the market. These are also logical units for the materialisation of construction works in the validated calculation tools. Examples are a frame in m^2 and hinges and locks per item. It is not logical to include hinges and locks in m^2.

A disadvantage is that any deviating units make product comparisons complex. Insight into the products that score better, or more poorly, is handy when optimising the design, which is why it is now also possible to express the ECI of a product per 'reference unit' of the element (component). Presenting this in both 'market unit' as well as in 'reference unit' concerns an additional functionality, which can be offered by the validated calculation tools. This other method of presentation is therefore a side issue and has no influence on environmental performance at construction work level.

The conversion factor in the calculation tools converts 'market units' into 'reference units'. This factor should be added to the product data in the NMD as an extra, which means that the factor falls within the product data quality control system. If a conversion factor cannot be determined, this must be stated in the product card notes.

2.8.3. Documentation on additional information

EN 15804 applies.

2.8.3. Data available for verification

EN 15804 applies.

In addition to EN 15804:

A project file for a construction product's LCA research must be compiled that contains at least the following:

- a version of the NMD 3.0 input interface filled in completely (input product cards NMD 3.0);
- the ingoing and outgoing environmental flows (environmental interventions) that have been used as input for the LCA calculations;
- the documentation (measurements, calculations, estimates, sources, correspondence, traceable references to origin, etc.) based which the process data for the LCA have been formulated. This includes documentation on the recipe used to determine the composition of the producer's construction product, energy consumption figures, emission data and waste production, as well as data substantiating completeness. In specific cases reference can be made to, for instance, standards or quality regulations;
- documentation that shows that the materials, products or elements (reference flow) can fulfil the desired function(s) and performance;
- the amounts of the materials, products or elements;
- documentation that shows that the selected processes and scenarios in the process tree comply with the requirements set by this Assessment Method;
- documentation substantiating the selected service life of the construction product;
- data with which sensitivity analyses and internal checks on the collected data have been implemented. The internal check includes a mass balance per process step, a mass balance at company level and an energy balance at company level;
- documentation and substantiation of the percentages used to calculate in the end-of-life processing scenario;
- documentation and substantiation of the percentages and figures (number of cycles, prices, etc.) used to calculate in the allocation procedure;
- for an environmental declaration of a weighted average for more than one production location or producer:
  - the unweighted values;
  - documentation from which the weighting factors (production quantities) used were derived;
- documentation with which any qualitative information is substantiated in the environmental declaration;
- information that shows that all suppliers and any relevant purchasers have been approached for the LCA research. If this has not happened, information must show that data have been used that can be considered as equivalent to data from suppliers (e.g. when the suppliers have published joint data for use in LCAs);
- procedures according to which the data collection has been implemented (questionnaires, instructions, information material, agreements on confidentiality, etc.);
- the characterisation factors used and where these are applied to calculate environmental parameters, normalisation factors and weighting factors;
- the criteria and the substantiation that have been used to determine system boundaries and the selection of incoming and outgoing flows;
- the representativeness of the generic data used in the absence of specific data for the LCA study;
- documentation to substantiate any other choices, scenarios and assumptions.

Example: Examples of documentation are: CPR 305/2011/EU, guidelines from the Standard RAW Provisions, regulations, guarantees, information from practice, publications, research, annual reports, audit opinions.

If the environmental profiles are included in the NMD, the basic profiles and the parameters for the product cards should form part of the verification.

2.9. Verification and validity of an EPD (EN 15804 9 Verification and validity of an EPD)

EN 15804 applies.

In addition to EN 15804:
For the EPD environmental information to be admitted to the NMD, the verifier must be recognised by Stichting NMD and the verification of the EPD, basic profile and product card must take place according to the NMD Verification protocol.

As indicated in the Verification Checklist on the PCR-NL, the NMD Verification protocol and MRPI®-EPD VERIFICATION PROTOCOL do not fully concur in terms of content for assessing whether the supplied environmental data are formulated in accordance with the Assessment Method. These differences are clarified in the Verification Checklist on the PCR-NL, so that an EPD verification can easily be elevated to a verification of an NMD product card.

3. Construction work calculations

3.1. General

EN 15978 was published to assess the environmental performance of buildings. EN 15804 is based on this and the building and civil engineering structure calculation is therefore also based on the EN 15978 system. A decision was made not to follow EN 15978 explicitly as there are various differences in the scope (including water and energy consumption) and supplements in accordance with the Dutch additions to EN 15804. Handling replacements (section 3.3.2) deviates methodologically from EN 15978.

The calculation rules are described in a separate document under the responsibility of Stichting National Environmental Database, with all calculation routines based on the current Assessment Method in a related private set of tools to achieve a validated calculation of the environmental performance of a building or structure. These have been formulated to comply with the Buildings Decree and to facilitate any extra legal and ancillary statutory calculations in the Dutch context. The scope of the calculation is included for information in Appendix V.

When using LCA environmental data from the National Environmental Database (NMD), the product cards present in the NMD at the time of the permit application or registration for a construction activity, application for a certificate or subsidy, tender or equivalent action should be observed (or: the status of the NMD at the time of the permit application or registration for a construction activity).

Only the percentage part of the environmental impact intended for building-related energy consumption of the use functions needs to be taken into account for the energy-performing facilities that are considered for the environmental performance calculation.

3.2. Use of product information

In principle, the three NMD product information categories are used to determine the environmental performance of construction works. The use of category 1 and 2 data is always preferred if available and applicable to the situation.

The NMD Verification protocol contains the equivalence procedure that indicates the conditions under which the environmental profiles that were not realised in accordance with chapter 2 of this Assessment Method, or environmental profiles of products that are not yet registered for inclusion in the NMD may be used.

3.3. Reference service life

3.3.1. Service life of construction works

For the service life of a building, a type-dependent reference service life is used, with the following reference service lives being used for the different types of buildings:

- homes: 75 years;
- utilities: 50 years (including schools, shops, sports halls, etc.).

In the case of mixed forms (e.g. dwellings above shops), 75 years will be the standard assumption for the structure.

The research report 'Specific Building Service Life Directive - intended for application with the environmental performance calculation "Specific Building Service Life Guideline"' (W/E 2020] provides indications for justified deviations from the reference service life. See the Stichting NMD website *www.milieudatabase.nl*.

For civil engineering structures, a reference service life of 100 years can be used or a specific service life per project.

3.3.2. Initial production and replacements

For each construction product, consideration should be given as to whether replacements are necessary during the functional unit's functional lifetime. This is the case when the service life of the construction product for the given situation is shorter than the functional unit's functional lifetime. The number of replacements is calculated by dividing the functional lifetime by the service life minus one (the initial production). The number of replacements can never be less than 0 here and is expressed as a minimum of 2 significant figures. For the initial production, a complete production is always assumed; this can never be less than 1, even if the product service life is longer than the functional lifetime.

This calculation is part of the calculation rules and is processed automatically in the approved calculation tools.

Example 1 For a functional lifetime of 75 years and a construction product service life of 25 years, the number of replacements is 2, namely: 75 ÷ 25 – 1 = 2.00; the initial production is included entirely in the calculation.

Example 2 For a functional lifetime of 75 years and a construction product service life of 20 years, the number of replacements is 2.75, namely: 75 ÷ 20 – 1 = 2.75; the initial production is included entirely in the calculation.

Example 3 For a motorway carriageway (2 lanes of 3.6 m wide and 1 emergency lane of 3 m wide) with a functional lifetime of 30 years, where the maintenance scenario is that the asphalt in the right-hand lane is replaced after 8, 16 and 24 years and the asphalt in the entire carriageway after 16 years, an asphalt layer will be replaced 2.56 times.

3.3.3. Existing buildings

The 'Environmental performance assessment of existing buildings that are to be renovated or transformed' [W/E, 2014] gives instructions on how to handle the residual value and depreciation of environmental impact, for calculating the environmental performance of the renovation or transformation. See the *www.milieudatabase.nl* website. This only applies to buildings and not to civil engineering structures.

3.4. Unforeseen reuse

In current practice, products that are entirely reused in a structure are not considered in the environmental performance calculation. This also means that replacements after the product's end of life are not included over the service life of construction works, nor is any maintenance during the use phase and the final impact (and benefits) at the actual end of life. For generic improvements here, calculation rules have been introduced for unforeseen reuse;

This concerns reuse of products for which reuse was not initially considered in the environmental performance calculation, of which the remaining service life is unknown or for which anticipated reuse has already been fully allocated to the initial product system (environmental benefits in module D, according to EN 15804 environmental benefits are allocated to the system that produces them).

Unforeseen reuse is used at the level of a product card in which the product is used in the same functional application.

The calculation rule has been detailed in a generic factor for reuse (H). This factor is determined (expert judgement) based on the following starting points;

- Simple and transparent;
- Acceptable approach to the actual environmental impact on reuse (so not 0);
- On average, reused products will not yet have 'written off' all of the original environmental impact, but they will have 'written off' a substantial part of it. On this basis, the free of burden principle is not applied at product level in the case of unforeseen reuse.
- Unforeseen reuse will further reduce in the future due to facilitation of product cards for reuse based on foreseen reuse.

In unforeseen reuse, the reuse factor is set at 0.2 as standard. This means that the ECI is multiplied by 0.2, applied to modules:
A1-A3;
C3, C4 and D
of the initial or the most representative product available in the NMD.

The environmental performance within the A4, A5, B, C1 and C2 modules will be calculated in the usual way. The service life of the reused product will be equalised to the reference service life of the original product. The calculation instruments must clearly show a marking for unforeseen reuse in the results at product and construction work level. A client can use this information for discussions on reuse within the building or structure.

The calculation rules for unforeseen reuse will of course not be used on product cards that have already been formulated based on a reused product, such as a renovation portal (Reno portal).
The reuse factor will be evaluated annually.

Example as illustration

Product; aluminium door comprising: aluminium frame, glass and door rubber.
The notional environmental performance in ECI of this product is as follows:

Product	Material	A1-3	B1	C3 + C4	D	ECI
	1 rubber	1.000	0.000	0.200	0.050	1.250
	frame	10.000	0.000	0.500	-4.000	6.500
	glass	5.000	1.000	1.000	-0.100	6.900
						14.650

Reuse factor (H)

The notional environmental performance in the event of unforeseen reuse of the door without modifications:

Material	A1-3	B1	C3 + C4	D	ECI
1 rubber	**0.200**	0.000	**0.040**	**0.010**	0.250
frame	**2.000**	0.000	**0.100**	**-0.800**	1.300
glass	**1.000**	1.000	**0.200**	**-0.020**	2.180
					3.730

The reuse factor 0.2 is applied to modules: A1-A3; C3, C4 and D

Reuse factor (H) + new production added

The notional environmental performance for unforeseen reuse of the door with modifications, in this example the replacement of broken door rubber:

Material	A1-3	B1	C3 + C4	D	ECI
1 rubber	**1.200**	0.000	**0.240**	**0.060**	1.500
frame	2.000	0.000	0.100	-0.800	1.300
glass	1.000	1.000	0.200	-0.020	2.180
					4.980

The reuse factor 0.2 is applied to modules: A1-A3; C3, C4 and D
The new door rubber is added as new production in A1-A3 and also in a new end-of-life processing scenario in C and D.

Effect on building service life

When applied at building level, the comparison between new and reuse without modification is as follows:

Everything new

Building service life 75
Door service life 15
ECI product 1 new 14.65
ECI product 1 replacement 58.6
TOTAL 73.25

Factor H applied to first cycle

Building service life 75
Door service life 15
ECI door unforeseen reuse 3.73
ECI door replacements 58.6
TOTAL 62.33

3.5. Calculation and other rules for category 3 data

A surcharge factor is applied to category 3 environmental profiles, because experience has shown that unverified environmental profiles often indicate a too low environmental impact as the inventory data are less complete, and to stimulate the submission of category 1 and 2 data to the database. This surcharge factor is set at 30%. This surcharge factor can be changed by the NDM administrator, Stichting NMD.
The surcharge factor applies at product level (so if the basic profile over modules A1-A3 is category 3, the surcharge of 30% will be applied to all modules except the benefits in module D, within that product). No net surcharge factor is applied over the benefits of module D.

For product cards of infrastructure for external energy supply the 30% surcharge factor does not apply and can be considered as fixed values. This also applies to product cards of construction elements/installations that are to be reused in new-build construction works.

Category 1 and category 2 environmental profiles that have been cancelled will be removed from the NMD. If no replacement non-proprietary data are available for these, they will be replaced by category 3 data managed by Stichting NMD. Where possible input from the cancelled product cards will be used in coordination with the data owner.

3.6. Weighting of environmental impact scores

Weighting environmental impact scores to one or a few scores is often desired by calculation tool users.
The compilers of this Assessment Method are aware of the objections against weighting but consider that, if weighting takes place, it is better that it takes place in a clear way. Weighting factor users should be aware that there is less consensus over weighting and weighting factors than over such things as characterisation factors and that the method also still has its uncertainties.

The RWS report by TNO-MEP 'Toxicity has its price: shadow pricing for ecotoxicity and other toxicity and depletion of abiotic raw materials within DuboCalc', 8 March 2004[8]is the source of the figures. From the summary: 'Scores for ten used environmental impact categories need to be weighted and combined to arrive at a single indicator for environmental impact. Various options are available here. One of these options is detailed in this report: the shadow pricing methodology. The shadow price is the highest permissible cost level for the government (prevention cost) per unit of emission control.' Compared to this report, one difference has been calculated: the factor for abiotic depletion amounts to €0.16 (set at 0 in the final version of the RWS report)[9].

[8] *Toxicity has its price: shadow pricing for ecotoxicity and other toxicity and depletion of abiotic raw materials within DuboCalc, Harmelen, drs. A.K. van, et al., TNO-MEP (commissioned by Rijkswaterstaat), Apeldoorn, 2004.*

[9] *Harmonisation normalisation/weighting and environmental data in Eco-Quantum, GreenCalc+ and DuboCalc, IVAM Amsterdam, 2004.*

Table 8: Weighting factors (for the environmental impact categories)

Environmental impact category	Equivalent unit	Weighting factor [€ / kg equivalent]
Depletion of abiotic raw materials (excluding fossil energy carriers) - ADP	Sb eq	€0.16
Depletion of fossil energy carriers - ADP	Sb eq[10]	€0.16
Global warming - GWP 100 years.	CO_2 eq	€0.05
Ozone layer depletion - ODP	CFK-11 eq	€30
Photochemical oxidant-formation - POCP	C_2H_4 eq	€2
Acidification - AP	SO_2 eq	€4
Eutrophication - EP	PO_4 eq	€9
Human toxicity - HTP	1.4-DCB eq	€0.09
Freshwater aquatic ecotoxicity - FAETP	1.4-DCB eq	€0.03
Marine aquatic ecotoxicity - MAETP	1.4-DCB eq	€0.0001
Terrestrial ecotoxicity - TETP	1.4-DCB eq	€0.06

Raw materials

Emissions

1-point score

The result per environmental impact category arises from the characterised impact scores being multiplied by the weighting factors per unit. No normalisation takes place in advance therefore.

3.7. Key environmental data

The ECI (environmental cost indicator) at construction work level refers to the total environmental impact over the building's or structure's service life (including the environmental impact or benefit declared in module D). This takes into account the quantities of product used in the building or structure and the number of product replacements.

For C&U (buildings) the ECI can be converted into the EPB - Environmental Performance of Buildings. The total impact is converted back to a functional unit of a building (per m^2 GFA per year).

The calculation rules state which results must be presented in a clearly recognisable and visible way.

3.8. Calculation rules for use in calculation tools

The Assessment Method has been translated into calculation rules that aim to:

- operationalise the Assessment Method;
- safeguard uniformity in results in the various calculation software packages (hereinafter referred to as calculation tools);
- safeguard that the calculation tools present certain backgrounds, key figures and overviews.

The calculation rules are available as separate documents on the Stichting NMD website (*www.milieudatabase.nl*) and must be considered for calculating the EPB and are part of the validation of the calculation tools. There are two parts to the calculation rules, one for general concepts and one for software implementation. In the case of inconsistencies, document two is leading.

[10] *If 'depletion of fossil energy carriers' is available in the MJ unit, the conversion factor 4.81E-4 kg antimony/MJ can be used [CMLIA, Part 2b: Operational annex, page 52]*

4. Literature

CMLIA — LCA methodology developed by the Center of Environmental Science (CML) of Leiden University in The Netherlands, version august 2016

CML-NMD — Characterisation factors according to the NMD Assessment Method, available via *www.milieudatabase.nl*

Specification Dubo*Calc* — Functional specification DuboCalc, NWP0800100-FS, Rijkswaterstaat, March 2010

MRPI Verification protocol — MRPI®-EPD VERIFICATION PROTOCOL JUNI 2021, V4.0: FINAL, v3 – Amsterdam June 2021

NEN-EN 15804:2012 — Sustainability of construction works - Product environmental declarations - Basic rules for the product group construction products

NEN-EN 15978 — Sustainability of structures – Assessment of the environmental performance of buildings – Calculation method

Oers et al.(2001) — LCA normalisation factors for the Netherlands, Europe and the world. RIZA working document 2000.059x, RIZA/CML, Lelystad/Leiden.

NMD Verification protocol — NMD Verification protocol for inclusion of data in the National Environmental Database, available via *www.milieudatabase.nl*

SBR Service life — Service life of construction products, methods for reference values, SBR, dated December 2011

TNO shadow pricing — Toxicity has its price: shadow pricing for ecotoxicity and other toxicity and depletion of abiotic raw materials within DuboCalc', Harmelen, drs. A.K. van, et al., TNO-MEP (commissioned by Rijkswaterstaat), Apeldoorn, 2004

Verification Checklist on the PCR-NL	Stichting NMD & Stichting MRPI®: VERIFICATION CHECKLIST - Requirements for obtaining MRPI®-EPDs for the Dutch market and inclusion of data in the Dutch National Environmental Database (NMD) – Amsterdam May 2021
W/E (2020)	Specific Building Service Life Directive - intended for application with the environmental performance calculation "Specific Building Service Life Guideline"' (W/E 2020]

Appendix I. Terms, definitions and abbreviations

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Additional technical information Information that is part of the EPD by providing a basis for developing scenarios.	EN 15804 (3.1)	Additional technical information
Background process Process over which the producer or supplier of the product/process being assessed has no direct influence and that takes place elsewhere in the chain (the production of electricity or a raw material, for instance). See also: 'front-end process'.	–	
Waste Substance or object that the owner discards or intends or is required to discard. NOTE: Adapted from the definition in the European Waste Directive 2008/98/EC.	EN 15804 (3.34)	Waste
Allocation Allocation of incoming and outgoing process or product system flows if one process generates or processes several materials or products.	EN 14044 (3.17)	
Basic process Description of inputs and outputs of a unit process in a process card in a process database.	–	
Basic profile Environmental profile of a Basic process. The profile is the result of the calculation of a Basic process in LCA software.	–	
Basic profile database Collection of basic profiles.	–	
Co-product One of two or more marketable materials, products or fuels from the same unit process that is not the subject of assessment. NOTE: Co-products, by-products and products have the same status and are used to identify a number of main product flows from the same unit process. Waste is the only co-product, by-product and product output that is distinguished as not being a product.	EN 15804 (3.7)	Co-product
Biogenic carbon Carbon obtained from or captured in biomass.	Derived from ISO/ DIS 14067	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Biomass Material of biological origin, excluding material embedded in geological formations and material transformed into fossil material.	ISO/DIS 14067	
Construction waste The totality of: • Product loss due to breakage during transport • Product loss due to damage/breakage at the construction site • Sawing waste at the construction site • Additional ordered material (to ensure a smooth process) Losses due to incidents during the use phase (roof tiles blown off, broken glass) are NOT included.	-	
Construction element Part of a construction work (building or civil engineering structure) with a certain combination of products. EXAMPLES: foundation, floor, roof, wall, systems.	EN 15804 (3.9)	Construction element
Construction product Item manufactured or processed for incorporation in construction works NOTE 1: Construction products are items supplied by a single responsible body. NOTE 2: Adapted from the definition in 6707-1:2004 according to the recommendation of ISO/TC 59/AHG Terminology. [prEN 15643-1] NOTE 3: Construction products are made from one or more materials. A distinction is made between generic and specific construction products.	EN 15804 (3.5)	Construction product
Construction works All construction works or structures that are constructed or result from construction activities. NOTE: This includes buildings and structures in earthworks, road-works and hydraulic engineering.	[NEN-ISO 6707-1:2004]	
Construction service Activities that support the construction process or subsequent maintenance.	EN 15804 (3.6)	Construction service

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Bulk material Material that is delivered to the construction site separately (not formed, unpackaged) and poured or stored in a silo. EXAMPLES: sand, gravel, soil, concrete mortar, etc.	-	
GFA Gross Floor Area	[NEN 2580]	
Product information categories Category 1: proprietary data, verified Category 2: non-proprietary data, verified Category 3: non-proprietary data, not verified See also: 'generic product' and 'specific product'	-	
Third party Person or body recognised as independent from the parties involved, with respect to the topic in question. NOTE: 'Involved parties' are usually the supplier ('first party') and buyer ('second party') and therefore have an interest. [EN ISO 14024:1999].	EN 15804 (3.31)	Third party
Ecoinvent Extensive database at intervention level, with a huge amount of data on production processes, energy generation and transport in Europe. NOTE: Developed and maintained by the Ecoinvent Center in Switzerland. Version 3.6 was published in September 2019.	-	
Unit process The smallest element considered in the LCIA (Life Cycle Inventory Analysis) in which the incoming and outgoing flows are quantified [EN ISO 14040:2006].	EN 15804 (3.35)	Unit process
Element group code (NL-SfB), element code and product code The first two digits of the elements in construction works are coded according to NL-SfB (e.g. element group code 31: exterior wall openings). The NL-SfB code has been supplemented with its own coding (31. XX.YYY) for further subdivision into elements and products.	-	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Functional equivalent Quantified functional requirements and/or technical requirements for a building or an assembled system (parts of structures) for use as a basis for comparison. NOTE: Adapted from the definition in ISO 21931-1:2010.	EN 15804 (3.11)	Functional equivalent
Functional unit Quantified performance of a product for use as a reference unit [ISO 14040:2006]. NOTE: See also declared unit.	EN 15804 (3.12)	Functional unit
Aggregated process A process that describes various unit processes.	-	
Average data Data representative of a product, product group or construction service, provided by more than one supplier NOTE: The product group or the construction process may contain similar products or construction processes.	EN 15804 (3.3)	Average data
Generic data Data considered representative for the relevant product (group) and established by the administrating organisation. These data are based on public data sources, but can also be based on verified data from producers or sectors, as long as they have given consent for the use of these data. See also 'specific data' and 'product information categories'.	-	
Raw material equivalent The raw material equivalent indicates how much and which primary production process (input module A, which can also contain secondary raw materials) can replace the relevant *secondary raw material* as they are technically equivalent.	-	
Reuse Reusing construction products or construction components/ elements in the same function, whether or not after processing. Examples are the reuse of insulation material as insulation material, a door as a door, a roof as a roof.	-	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Renewable energy Energy from renewable, non-fossil sources, EXAMPLES Wind, sun, aerothermal, geothermal, hydrothermal and tidal energy, hydropower, biomass, landfill gas, gas from wastewater treatment plants and biogas. NOTE: Adapted from the definition in Directive 2009/28/EC.	EN 15804 (3.23)	Renewable energy
Renewable resource Raw material from a source that is grown, naturally replenished or cleansed in a human timescale. NOTE: A renewable resource can be depleted, yet continue to exist indefinitely with good stewardship. Examples include: trees in forests, grasses in pastures, fertile soil. [ISO 21930:2007] A renewable resource can be of either abiotic or biotic origin.	EN 15804 (3.24)	Renewable resource
Horizontal aggregated process Averages of processes with the same function.	[Verification protocol]	
Ancillary material Material or product used by the unit process when producing the product, but which is not part of the product. [ISO 14040].	EN 15804 (3.2)	Ancillary material
Information module Collection of data to be used as the basis for a Type III environmental declaration covering a unit process or a combination of unit processes that are part of the life cycle of a product. [ISO 14025]. NOTE: In EN 15804, an information module is part of Figure 2, a part of a life cycle phase. For example: 'A1 Raw material supply'	EN 15804 (3.13)	Information module
Capital goods Resources, such as relief supplies, equipment and buildings required to carry out an activity and which are used repeatedly and the depreciation of which takes place over several products. EXPLANATION: factories and machinery are examples of capital goods.	-	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Quality factor K product reuse A measure of a product's remaining quality (not material flows) compared to the initial product. The K factor is expressed in a % between 1 and 100.	-	
Reuse factor H Generic factor set in the Assessment Method for calculating the ECI of a product during unforeseen reuse.	-	
Life Cycle Assessment (LCA) The identification and evaluation of incoming and outgoing flows, and potential environmental impacts of a product system during its life cycle [EN ISO 14044:2006].	EN 15804 (3.14)	Life cycle a ssessment
Life Cycle Inventory Analysis (LCI) Phase in life cycle analysis where an inventory is made of the nature and quantity of all incoming and outgoing flows for a product throughout its life cycle [ISO 14040]. NOTE: In addition to economic flows (purchase of raw materials, energy and waste processing and sale of products), this also includes environmental interventions (extractions from the environment and emissions to the environment).	EN 15804 (3.15)	Life cycle inventory analysis
Materials for recycling EN 15804 does not provide a specific definition for ***materials for recycling.*** However, a definition is given by the fact that *materials for recycling* must be declared as output flow (from the system) and that the system boundary for waste processing is at the end-of-waste phase. Based on this, the following specific definition can be given: - *Materials for recycling* are materials that result from a waste or other treatment process and have reached the end-of-waste phase. *Materials for recycling* can be used in another product system as *Secondary material.* The modular approach of EN 15804 states that all impacts resulting from processing waste until the end-of-waste phase must be declared in module C3. This is the specific module of the waste phase (module C) in which the *materials for recycling* leave the system as output flow. The efficiency of a treatment process means that not all materials are actually released as materials for recycling. The non-usable waste and other flows from the treatment process should also be declared in module C3.	- -	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Environmental impact category Category representing an environmental aspect, to which results from an LCI can be assigned. EXAMPLES: depletion of raw materials, increased greenhouse effect, human toxicity.	EN 14044 (3.39)	
Environmental intervention A flow that has been extracted from the environmental system and enters an economic system unprocessed, or a flow that leaves an economic system and enters the environmental system unprocessed. EXAMPLE: Examples include: extraction of raw materials, extraction of land, emissions, noise emissions.	NEN 8006	
Environmental performance Performance with respect to environmental impact and environmental aspects [ISO 15392:2008]; [ISO 21931-1:2010].	EN 15804 (3.10)	Environmental performance
Environmental profile The outcome of an LCA is an environmental profile: a kind of score list of environmental impact. The environmental profile shows which environmental impacts play the most important role in the life cycle. The environmental profile comprises the environmental impact categories that are mentioned in Assessment Method section 2.6.5.	-	
National Environmental Database (NMD) Database with product cards and the associated environmental profiles that are used to determine the environmental performance of buildings and structures.	-	
Non-renewable energy Energy from sources that are not defined as renewable energy sources.	EN 15804 (3.16)	Non-renewable energy
Non-renewable resource Raw materials that exist in finite amounts that cannot be replenished in a human timescale [21930:2007].	EN 15804 (3.17)	Non-renewable resource
Surcharge factor Factor by which environmental data (results) not verified according to the Verification protocol are given a surcharge. See § 3.3.	-	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Unforeseen reuse Reuse of products for which reuse was not initially considered in the environmental performance, of which the remaining service life is unknown or for which anticipated reuse has already been fully allocated to the previous product system (environmental benefits in module D, according to EN 15804 environmental benefits are allocated to the system that produces them).	-	
Performance Indication of the size of a particular aspect of the considered product, related to certain requirements or goals NOTE: Adapted from the definition in ISO 6707-1:2004 according to the draft recommendation of ISO/TC 59 Terminology.	EN 15804 (3.18)	Performance
Primary raw material Raw material that is produced by the earth and is used by people for the production of materials and products.	-	
Primary material Construction material that is produced from primary raw materials.	-	
Primary production A production process based on primary raw materials.	-	
Process database A database with a collection of basic processes managed by Stichting NMD. The category 3 basic profiles are generated via the process database.	-	
Product That which is marketed by the supplier and purchased by the buyer for use during a building's or structure's life cycle. A product can be a physical product (e.g. 1 m2 of window frame), but also an activity (e.g. 1 tkm of rail transport).	-	
Producer The producer, or its representative, or the importer of a product for the Dutch market.	-	
Product category Group of construction products that can fulfil equivalent functions NOTE: Adapted from ISO 14025:2006	EN 15804 (3.19)	Product category
Product system Collection of unit processes with interventions (emissions and extractions) and product flows, which fulfils one or more defined functions, and describes the life cycle of a product [ISO 14040].	EN 15804 (3.21)	Product system

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Product category rules (PCR) Set of specific regulations, requirements and guidelines for the development of type III environmental declarations for one or more product categories [ISO 14025].	EN 15804 (3.20)	Product category rules
Declared unit Amount of a construction product for use as reference unit in an EPD for an environmental declaration based on one or more information modules. EXAMPLE Mass (kg), volume (m^3) [Copied from ISO 21930] See also: functional unit.	EN 15804 (3.8)	Declared unit
Product card Information about a product or process (materials, quantities per FU, service life (cycles), emissions during use phase, construction waste and end-of-life processing scenario).	-	
Programme operator Body or bodies that run a Type III environmental declaration programme. NOTE: A programme operator can be a company or a group of companies, industrial sector or industry organisation, governments or governmental agencies, or an independent scientific institute or other organisation. Stichting MRPI and Stichting NMD run a Type III environmental declaration programme in the Netherlands.	EN 15804 (3.22)	Programme operator
Recycling Recovering materials and raw materials from discarded products and reusing them to make products.	-	
Reference service life of a construction product or building system A construction product's or building system's service life that is known under certain conditions, meaning a reference of conditions for use that can serve as a basis for estimating the service life under other use conditions [ISO 21930:2007].	EN 15804 (3.25)	Reference service life (RSL)
Reference service life of construction works A standard [default] for a building's service life generally associated with the function	-	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Reference service life data Information containing the reference service life and any qualitative and quantitative data for which this service life is valid. EXAMPLE Characteristic data describing the validity of the RSL include the description of the component (3.10) to which it applies, the reference conditions of use under which it applies, and its quality. [ISO 15686-8]	EN 15804 (3.26)	Reference service life data (RSL data)
Scenario Collection of assumptions and information about an expected range of possible future events.	EN 15804 (3.27)	Scenario
Scaling When scaling products, dimensions (measurements) other than the standard (default) dimensions specified in the product card are given when assessing construction works NOTE: The type of scaling is stated per product card. The following options are possible: • None • Linear • Exponential • Logarithmic	-	
Secondary material All material that replaces primary materials and originates from previous use or from waste. NOTE: 1 Secondary material is measured at the point at which the secondary material enters the system from another system. NOTE 2: Materials originating from previous use or from waste from one product system and used as input in another product system are secondary materials. NOTE 3: Examples of secondary materials (to be measured at the system boundary) include recycled scrap metal, crushed concrete, broken glass, recycled wood chips and recycled plastic. As the system boundary of waste streams is at the point that 'end-of-waste' is achieved, a *secondary material* enters a product system as an input without environmental impact.	EN 15804 (3.29)	Secondary material

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
Secondary fuel Any fuel recovered from previous use or from waste that replaces primary fuels. NOTE 1: Processes from which a secondary fuel is produced are considered from the point at which the secondary fuel enters the system from the previous system. NOTE 2: Every combustible material originating from previous use or from waste from the previous product system and used as fuel in a subsequent product system is a secondary fuel. NOTE 3: Examples of primary fuels are: coal, natural gas, biomass, etc. NOTE 4: Examples of secondary fuels originating from previous use or waste include solvents, used wood, used tyres, used oil and animal fats.	EN 15804 (3.28)	Secondary fuel
Secondary production A production process based on secondary materials.	-	
Specific data Data about one specific producer. NOTE: These data are verified in accordance with the Verification protocol and are submitted to the management organisation. See also 'generic data' and 'product information categories'.	-	
Specific data Data that are representative for a product, product group or construction process, delivered by one supplier.	EN 15804 (3.30)	Specific data
Substance group Group of substances, such as nitrogen oxides (NOx). This is in contrast to nitrogen dioxide (NO2). NOTE: Some measurement methods present a quantity of a certain substance group. Substance groups cannot always be characterised properly.	-	
System process Process card within Ecoinvent that describes the environmental interventions of all process steps up to the current 'aggregated' step (= vertical aggregation). NOTE: Compare unit process.	-	

Term (if applicable: translation from EN 15804) and explanation	Source	'Terms' (EN 15804)
TYPE III environmental declaration (synonymous with: EPD) Environmental declaration that provides quantified environmental data based on parameters determined in advance and, if applicable, additional environmental information. NOTE: The calculation of predetermined parameters is based on the ISO 14040 series of standards, which consists of ISO 14040 and ISO 14044. The selection of the predefined parameters is based on ISO 21930 (adapted from ISO 14025).	EN 15804 (3.32)	Type III environmental declaration
Unit process Process card within Ecoinvent that describes the environmental interventions of a single process step. NOTE: Compare system process.	-	
Comparative assertion Environmental claim related to the superiority or equivalence of a product compared to a competitive product that performs the same function [ISO 14044]	EN 15804 (3.4)	Comparative assertion
Vertical aggregated process Sum of the various related processes (vertically in the chain).	-	
End-of-life processing scenario Division according to waste treatment/destination of a material/ application combination. NOTE: Processing options include landfill, incineration and recycling (with or without reprocessing).	-	
Volume transport factor Most transport models assume mass transport (mass x distance; tonne x km). Products with a low density should be corrected for this. NOTE: In the case of mass transport the volume transport factor is 1.	-	
Upstream, downstream process Process that either precedes (upstream) or follows (downstream) a certain life cycle phase.	EN 15804 (3.33)	Upstream, down-stream process
Front-end process Process over which the producer or supplier of the product/process being assessed has direct influence (at least its own production). See also 'background process'.	-	

Abbreviations

Abbreviations	
WIP	Waste incineration plant
C&U	Civil and Utility construction
c-PCR	Complementary Product Category Rules
EPD	A product's Environmental Product Declaration
ESL	Estimated service life
Civil Engineering	Civil engineering structures
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory Analysis
LCIA	Life Cycle Impact Assessment
LHV	Lower Heating Values
ECI	Environmental Cost Indicator
EPB	Energy Performance of Buildings
MRPI®	Environmentally Relevant Product Information
NMD	National Environmental Database
PCR	Product Category Rules
RSL	Reference service life
Stichting NMD	Stichting National Environmental Database
TIC	Technical Committee (advisory body for Stichting NMD)

Environmental impact abbreviations	
ADP	Abiotic Depletion Potential *Depletion of abiotic raw materials. Measure of scarcity of raw material with respect to reference resource antimony (Sb)*
AP	Acidification Potential *Acidification in SO_2 equivalents*
CTU	Comparative Toxic Units *Used to quantify the interactions of toxicants in binary mixtures of chemicals*
EP	Eutrophication Potential *Eutrophication in PO_4 equivalents*
FAETP	Freshwater Aquatic Ecotoxicity potential *Freshwater aquatic ecotoxicity relative to 1.4-Dichlorobenzene*
GWP 100 years	Global Warming Potential *Global warming potential expressed in CO_2 equivalents The addition of 100 years relates to the timescale*
GWP - luluc	Global Warming Potential – land use and land use change *Global warming due to land use and changes in land use, expressed in CO_2 equivalent*
HTP	Human Toxicity Potential *Human toxicity relative to 1.4-Dichlorobenzene*
MAETP	Marine Aquatic Ecotoxicity Potential *Marine aquatic ecotoxicity relative to 1.4-Dichlorobenzene*
ODP	Ozone Depletion Potential *Measure of ozone layer depletion, in CFC-11 equivalents*
PM	Particulate Matter *Particulates*
POCP	Photo-Oxidant Creation Potential *Photochemical oxidant formation (smog formation), in ethylene (C2H4) equivalents*
TETP	Terrestrial Ecotoxicity Potential *Terrestrial ecotoxicity relative to 1.4-Dichlorobenzene*
WDP	Water Deprivation Potential *Potential water shortage*

Appendix II. Agreements and procedures category 3 cards

Objective of category 3 product cards

1. Availability of generic product cards at the level of the total product and relevant sub-products to enable a complete calculation at construction work level.
2. Availability of at least one generic alternative in addition to the verified proprietary or non-proprietary information.

Basic principles of category 3 product cards;

1. Stichting NMD is owner of the category 3 cards
2. Category 3 cards can concern a product
3. Category 3 cards can, where relevant, be divided into components and be fully transparent in the viewer
4. Category 3 cards are compiled from generic information (inadequate differentiation is avoided and, where necessary, combined in the profile description)
5. Category 3 cards always have (including the surcharge factor) a poorer environmental performance than a comparably verified product

Content of category 3 product cards

A category 3 card contains all product and life phase information in accordance with the Assessment Method and the data format. Indicators that cannot automatically be calculated using the LCA software will be included as 'ND' (not declared). The sources used are included in the explanatory notes so that this is transparent for users.

The environmental profiles per module (the module profiles) are composed of one or more basic profiles from the process database, starting from generic Ecoinvent processes. In the process database, Ecoinvent processes are used directly where possible to avoid unnecessary naming (layers), etc.

Stichting NMD administers category 3 cards in close collaboration with the relevant parties in the construction field. Sectors can submit proposals. However, Stichting NMD is responsible for whether or not these proposals are adopted. The TIC is asked to advise in the case of modifications to existing cards based on suggestions from the market.

A surcharge factor is applied to category 3 environmental profiles, as experience has shown that unverified environmental profiles often indicate a too low environmental impact. Sometimes certain environmental impact is missed. This surcharge factor is set at 30%. This surcharge factor can be changed by the National Environmental Database administrator, Stichting NMD. See also chapter 3.4. Calculation and other rules for category 3 data.

Procedures

The following procedures are safeguarded by Stichting NMD in relation to category 3 products;

1. Standard management and maintenance
    a. TIC considers in each consultation whether there are reasons to update the generic processes in the process database – Ecoinvent
    b. Stichting NMD ensures that the process database and basic profiles are updated where necessary.
    c. The environmental profiles per module are recalculated with the adapted basic profiles in the NMD
    d. Data are checked for ECI compared with verified variants within the own functional unit (check on basic principle 5)
    e. Stichting NMD decides on the update, possibly after adjustment as a result of generic or specific undesired effects
    f. The update is finalised in the category 3 cards
    g. The new version is announced on the website

2. Producing new product cards
    a. Stichting NMD produces new category 3 cards if a new element, newly verified total product, or newly verified partial product is added to the NMD
    b. Stichting NMD determines which sources are used to produce the card and who is involved as expert
    c. Category 3 cards are produced in accordance with the content requirements
    d. Stichting NMD adopts the category 3 card
    e. The new card is added to the NMD
    f. New cards are announced on the website

3. ECI check for newly verified product cards
    a. Stichting NMD receives the newly verified data
    d. Data is checked for ECI compared with category 3 variants within the own functional unit (check on basic principle 5)
    c. If the category 3 card has a better ECI, this will be updated to an equivalent ECI
    d. The update is finalised in the category 3 cards
    e. The new version is announced on the website

4. Participation and complaints
    a. Stichting NMD receives input on the category 3 cards (including the profiles used)
    b. Stichting NMD assesses whether the input is sufficiently specific and coordinates with the submitter over any unspecific input
    c. Input receives advice from the compiler or relevant expert of the category 3 card
    d. Input will be submitted with advice to the TIC at the next regular meeting
    e. Stichting NMD decides whether or not to modify the category 3 card
    f. Stichting NMD provides feedback to the submitter

Appendix III. System boundary information

This appendix contains an overview of the processes that fall within the system boundaries. The following checklist does not claim to be complete. System boundaries are determined in accordance with EN 15804 and the Assessment Method.

Production phase (A1-A3)

Processes at the companies of the involved producer(s)

- all processes at the companies that are needed for production[11];
- ancillary materials, maintenance materials, additives and similar;
- production losses; gross process data are used;
- internal transport;
- internal storage and breakdown;
- water and air cleaning processes (also when these take place externally);
- recycling/processing of production waste;
- the 'packaging' process with the packaging material as raw material;
- production, maintenance and end-of-life of capital goods (equipment).
  If the contribution of capital goods to each individual environmental impact category of the production phase module (A1-A3) is less than 5%, based on substantiation, this may be disregarded.
- overhead processes (offices and similar) can generally be omitted.

Processes of direct suppliers

- all processes at the direct suppliers[12];
- transport from the supplier to the producer;
- return transport (empty) for trucks and vessels, not for rail transport. Return transport may only be omitted if it can be demonstrated that a truck or vessel will return loaded;
- the production, use and end-of-life processing of packaging materials of raw materials required for production;
- ancillary materials, maintenance materials, additives and similar;
- packaging materials at the direct suppliers;
- external cleaning and treatment processes.

Processes of the 'suppliers of the suppliers'

- transport of the most important substances and materials between all locations;
- return transport (empty) for trucks and vessels, not for rail transport. Return transport may only be omitted if it can be demonstrated that a truck or vessel will return loaded.
- For the rest, the same as direct suppliers as far as possible.

[11] *Materials representing less than 1% by weight of the average composition of the product that is subject to the environmental declaration may be disregarded. The exception to this rule is the situation in which the production of the constituent material that is omitted is expected to contribute more than an estimated 5% to one of the product's environmental impacts. In that case, the relevant material must be included. As an additional requirement, the sum of environmental impact not taken into account in this way may not exceed 5% of the total per environmental impact category.*

[12] *All processes fall within the system boundaries. This means that they will be mentioned. For 'data collection' a description is given of how the data were collected.*

Transport phase and building/installation/construction (A4- A5)

Transport to the construction site (A4)

- transport of all materials, products or elements to the construction site. Return transport is considered as empty unless demonstrated otherwise.[13]

Building/installation/construction (A5)

- the processes to apply the materials/products/elements during the work
- the disposal with return transport and processing of residual material, including packaging material, generated during application. As minimum percentage for packaging material the percentage stated in the National Waste Management Plan (LAP3) applies, unless demonstrated otherwise.
- production, maintenance and end-of-life of capital goods (equipment). If it can be demonstrated that the contribution to the functional unit is negligible (<<1% based on well-founded estimate), then production, maintenance and end-of-life processing of capital goods can be omitted.

Use and maintenance phase (B1-B5)

Use (B1)

- chemical and physical reactions in which materials change, and mechanical processes (such as erosion or leaching) are included in the use phase if part of a material from the bill of materials dissipates into the environment and if this can be measured and thus tested;
- intake of substances from and release of substances to the environment are included if this intake can be measured and/or this release can be demonstrably measured and thus verified.[14]

Maintenance and replacements (B2-B5)

- maintenance processes needed to retain the functional performance requirements from the functional unit for the duration of the function[15];
- the production of maintenance materials;
- delivery and removal, including return transport, of maintenance material (such as products to the construction site) and waste (such as construction waste);
- the maintenance waste treatment processes;
- cleaning maintenance only if this is functionally important;
- the production of replacement products;
- delivery and removal of replacement products (such as products to the construction site) and waste (such as construction waste);
- installation of replacement products during the work and demolition of parts to be replaced;
- waste treatment processes.

[13] *Delivery and removal of staff may be omitted.*

[14] *'Demonstrably' here means that an Assessment Method in accordance with a NEN standard must be available to determine the intake or release.*

[15] *Unforeseen repairs due to incidents and emergencies fall outside the system boundary.*

Demolition and processing phase (C1-C4)

Demolition phase (C1)

- demolition processes and dismantling[16].

Transport from the construction site to the processing site (C2)

- transport from the construction site to the waste processing site of all materials/products/elements, including return transport

Processing phase (C3-C4)

- if applicable: product reuse;
- the disposal process if a material is disposed of;
- if applicable: recycling processes up to end-of-waste.

Environmental impact and benefits of recycling and product reuse (D)

- if applicable: energy recovery. This is considered as closed-loop recycling, in which all related environmental interventions are included (see Assessment Method under 1.3.2);
- if applicable: construction elements and installations that can be reused in their entirety. In principle, the regulations described in chapter 2 apply to this.

[16] *Manual processes can be omitted.*

Appendix IV. Step-by-step plan to determine end-of-waste

Step-by-step plan to determine end-of-waste

1. Use the general criteria as also stated under EN 15804 6.3.4.5 end-of-waste status to determine whether there is waste[17]:
    - the material[18] is commonly used for specific objectives
    - there is a market for or there is demand for the substance or material
    - the substance or the material meets the technical requirements for the specific objectives and complies with the legislation and standards that apply to products
    - using the substance or material will generally not have any negative effects on the environment or human health.

    If there is clearly no (more) waste, it stops here. Otherwise:
2. Determine whether end-of-waste criteria have already been determined for the relevant flow (in so-called Technical proposals) by JRC via *https://publications.jrc.ec.europa.eu/repository/handle/JRC53238*[19].
   If that is not the case:
3. Determine whether criteria have been developed at national level. In the Netherlands this is currently on the case for 'Recycling granulates from brick-like waste substances: Regulation No. IENM/BSK-2015/18222 dated 5 February 2015.'
4. Check whether product category rules (c-PCRs) exist for the product.
   If so, determine whether the relevant (waste) flow is mentioned and whether there is an indication of how to handle this. If that is not the case:
5. Use the four main criteria (see under 1) to determine as precisely as possible if there is waste. If it is not practically possible to determine this using these four criteria, the principle of economic allocation can be used. The system boundary is determined by the economic tipping point. If the economic tipping point is reached in a treatment process, this will still have to be attributed entirely to the product system in which the waste is generated. The obtained secondary raw material can therefore be used in the production phase of a new product system, free from any environmental impact.

NOTE: Please note that the term end-of-waste can be misleading. From the flow diagram in Annex B 'Waste', EN 15804 shows that in any event modelling must continue until the waste is disposed of (in the form of incineration or landfill) or is used in another product system. An example of this is IBC construction materials, which are formally still waste, but which are put to good use. The step-by-step plan can be used to substantiate that the IBC building materials have reached end-of-waste status in the context of the LCA when they are collected at an earth bank. In this way the construction material:
1) is commonly used for a specific purpose (IBC application),
2) is offered on the market that exists for this (it has a positive market value),
3) meets the technical and statutory requirements (from the Soil Quality Decree), and
4) under the condition of the Soil Quality Decree, has generally no adverse effects on the environment or human health during use (primary raw materials are even saved).

[17] *Source of Dutch text: https://www.afvalcirculair.nl/afval/kaderrichtlijn/*

[18] *'material' appears to be a better term in this connection than 'object'*

[19] *https://www.afvalcirculair.nl/onderwerpen/afval/ indicates:*
- *Scrap iron, steel and aluminium: Regulation (EU) No. 333/2011 dated 31 March 2011*
- *Recycled glass: Regulation (EU) No. 1179/2012 dated 10 December 2012*
- *Scrap copper: Regulation (EU) No. 715/2013 dated 25 July 2013*

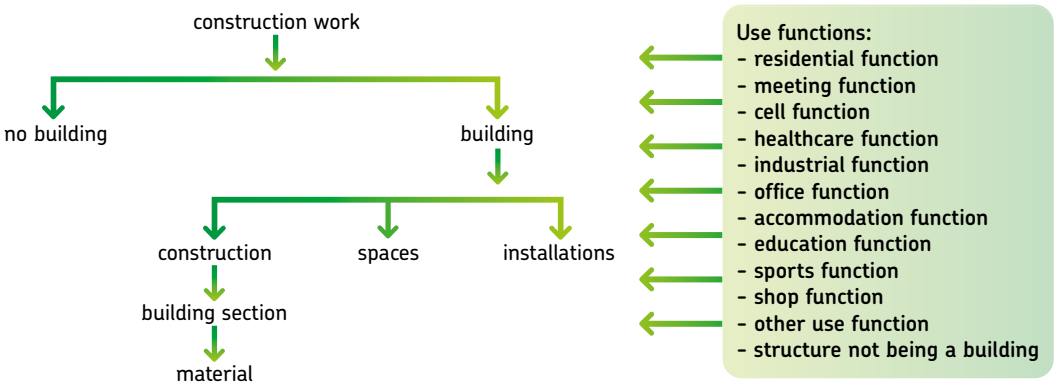
but not waste paper, waste plastic, biodegradable waste

APPENDIX V. Information indicating which structures and installations must be taken into account in assessing the environmental performance of a use function or building and an overview of the scope of a construction calculation

Introduction on indication

The Assessment Method only indicates how the environmental performance of a building or structure should be determined. In itself, the method does not determine which collections of materials must be considered. This takes place in the regulations that set quality requirements for construction works with reference to the Assessment Method.

The Assessment Method is suitable for calculating the environmental performance of construction works. And therefore also of a use function.
Construction works can be divided into buildings and other structures (that are not buildings). The diagram below indicates how the Buildings Decree uses the use functions to set requirements on construction works and components of these. The division of construction works into use functions determines the requirements that apply under the Buildings Decree for the relevant parts of the construction works.



For example, the Building Decree sets requirements for the environmental performance of the residential function and the (office) building. It also indicates that calculations for the environmental regulation in the Buildings Decree only need to take into account of the environmental impact of the complete constructions and installations to which other technical regulations of the Buildings Decree are associated; for example, regulations relating to construction and fire safety, health, energy performance, installations, etc. Use and presence regulations are not included.

The Buildings Decree sets requirements on both a use function and on a building. An essential difference in the definitions is that, to meet the environmental performance of a residential function, constructions and installations of auxiliary functions are not taken into account, while for a building they are.

The explanation in the Buildings Decree for the regulation on environmental performance states that:

1. The set limit values relate to an environmental performance expressed in a 1-point score as referred to in table 8 (weighting factors) of the Assessment Method;
2. In determining the environmental performance, in this case, only the construction components and installations to which other technical requirements of the Building Decree are associated are included.
3. As stated in the Assessment Method section 3.6, the environmental performance of building functions is converted back to m^2 of gross floor area.

This means that the environmental performance of the residential function and (office) building is determined by dividing the environmental impact of the materials allocated to that use function by the gross floor area (GFA in m^2) allocated to the residential and office function and expressing this in a 1-point score per m^2.

Under the building regulations, all permit-free construction services that are included in the construction of a new building or structure must also comply with the new-build requirements applicable to that building or structure. The end result must meet the new-build requirements on delivery. This means that if, for example, a dormer is placed on a new-build house without a permit, it must be included in the environmental performance calculation.

As a rule, schemes such as Sustainable Purchasing, MIA/VAMIL and certification of sustainable real estate according to BREEAM-NL follow this categorisation. In theory, this categorisation is comprehensive. However, a pragmatic mode of demarcation has developed in daily practice. This informative section of the Annex provides an overview of the elements that are mainly considered in the environmental performance calculation in practice.

Information for calculating the environmental performance of a residential function and (office) building

The gross floor area of the building of which the use or auxiliary function is a part is determined in accordance with NEN 2580.

In the case of buildings with several use functions, an environmental performance calculation is made of the entire building, after which the environmental impact or environmental performance is divided proportionally over the percentage gross floor area of a use function and the total of that of the present use and auxiliary functions.

To determine the environmental performance of a use function, the LCA environmental value of construction and other products and installations that are reused in their entirety in new-build construction works can be calculated with;
- A product card for the reused product or if this is not available;
- The reuse factor (H) included in Assessment Method for unforeseen reuse.

Information on which constructions and installations must generally be considered in the environmental performance of construction works.

This informative part of the Appendix is only included digitally in the NMD. The structure is explained in this physical Appendix.

The NMD includes an overview of the scope of the construction calculations for the various use functions from the Buildings Decree. All products and process cards managed by Stichting NMD are coded according to the use functions for which the products apply.

The products marked with an 'x' indicate the scope of an Energy Performance of Buildings (EPB) calculation in line with the Buildings decree.
The products marked with an '0' indicate the scope of an Environmental Cost Indicator (ECI) or EPB calculation in a broader application (above and alongside statutory requirements).

Construction works - building - example table to illustrate the structure

		Use functions								Type		
			Office building									
Code	Functional building elements / Element method 2005	Residential function	Office function	Meeting function	Industrial function	Educational function	Accommodation function	Healthcare function	Shop function	New-build	Renovation	Temporary building
1-	FOUNDATIONS											
11.1	Soil services; soil											
11.10	Soil services; soil, general (collection level)	x	x	x	o	o	o	o	o	x		x
11.2	Soil services; water	x	x	x	o	o	o	o	o	x		x
13.1	Floors on foundations; non-structural	x	x	x	o	o	o	o	o	x	o	x
13.2	Floors on foundations; structural	x	x	x	o	o	o	o	o	x	o	x
16.1	Foundation constructions; feet and beams	x	x	x	o	o	o	o	o	x	o	x
16.2	Foundation constructions; retaining walls	x	x	x	o	o	o	o	o	x	o	x
17.1	Pile foundations; not driven	x	x	x	o	o	o	o	o	x		x
17.2	Pile foundations; driven	x	x	x	o	o	o	o	o	x		x
2-	BUILDING SHELL											
21.1	External walls; non-structural	x	x	x	o	o	o	o	o	x	o	x
21.10	External walls; non-structural, general (collection level)	x	x	x	o	o	o	o	o	x	o	x
21.11	External walls; non-structural, solid walls	x	x	x	o	o	o	o	o	x	o	x
21.12	External walls; non-structural, cavity walls	x	x	x	o	o	o	o	o	x	o	x
21.13	External walls; non-structural, system walls	x	x	x	o	o	o	o	o	x	o	x
21.14	External walls; non-structural, fleece walls	x	x	x	o	o	o	o	o	x	o	x
21.15	External walls; non-structural, parapets	x	x	x	o	o	o	o	o	x	o	x
21.16	External walls; non-structural, fascias	x	x	x	o	o	o	o	o	x	o	x
21.2	External walls; structural	x	x	x	o	o	o	o	o	x	o	x
21.20	External walls; structural, general (collection level)	x	x	x	o	o	o	o	o	x	o	x
21.21	External walls; structural, solid walls	x	x	x	o	o	o	o	o	x	o	x
21.22	External walls; structural, cavity walls	x	x	x	o	o	o	o	o	x	o	x
21.23	External walls; structural, system walls	x	x	x	o	o	o	o	o	x	o	x
21.24	External walls; structural, parapets	x	x	x	o	o	o	o	o	x	o	x
4-	FINISHES											
43.2	Flooring finishes; not raised	o	x	x	o	o	o	o	o	x	o	x
43.20	Flooring finishes; not raised, general (collection level)	o	x	x	o	o	o	o	o	x	o	x
43.21	Flooring finishes; not raised, coatings	o	x	x	o	o	o	o	o	x	o	x
43.22	Flooring finishes; not raised, coverings	o	x	x	o	o	o	o	o	x	o	x
43.23	Flooring finishes; not raised, system flooring finishes	o	x	x	o	o	o	o	o	x	o	x

Construction works - not a building - example table to illustrate the structure

		Type		
Code	RAW 2015	New-build	Renovation	Temporary building
17.00	Contaminated Soil and Contaminated Water	o	o	o
17.51	Contaminated Soil and Contaminated Water, Sealing layer	o	o	o
22.00	Earthworks	x	o	o
22.03	Earthworks; Soil processing	x	o	o
22.41	Earthworks; Lightweight Fill materials	x	o	o
22.45	Earthworks; Plastic Fill material	x	o	o
22.46	Earthworks; Ground Reinforcement and Ground Separation	x	o	o
22.51	Earthworks; WIP Bottom ash	x	o	o
22.80	Earthworks; Banks and verges	o	o	o
23.00	Drainage	x	o	o
23.51	Drainage; Vertical Drainage	x	o	o
23.80	Drainage; Drainage sand	x	o	o
25.00	Pipelines	o	o	o
25.21	Pipelines; Concrete Pipes	o	o	o
25.22	Pipelines; Plastic Pipes	o	o	o
25.23	Pipelines; Metal Pipes	o	o	o
25.24	Pipelines; Ceramic Pipes	o	o	o
25.26	Pipelines; Wells and gullies, Sewerage	o	o	o
25.51	Pipelines; Culverts	o	o	o

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