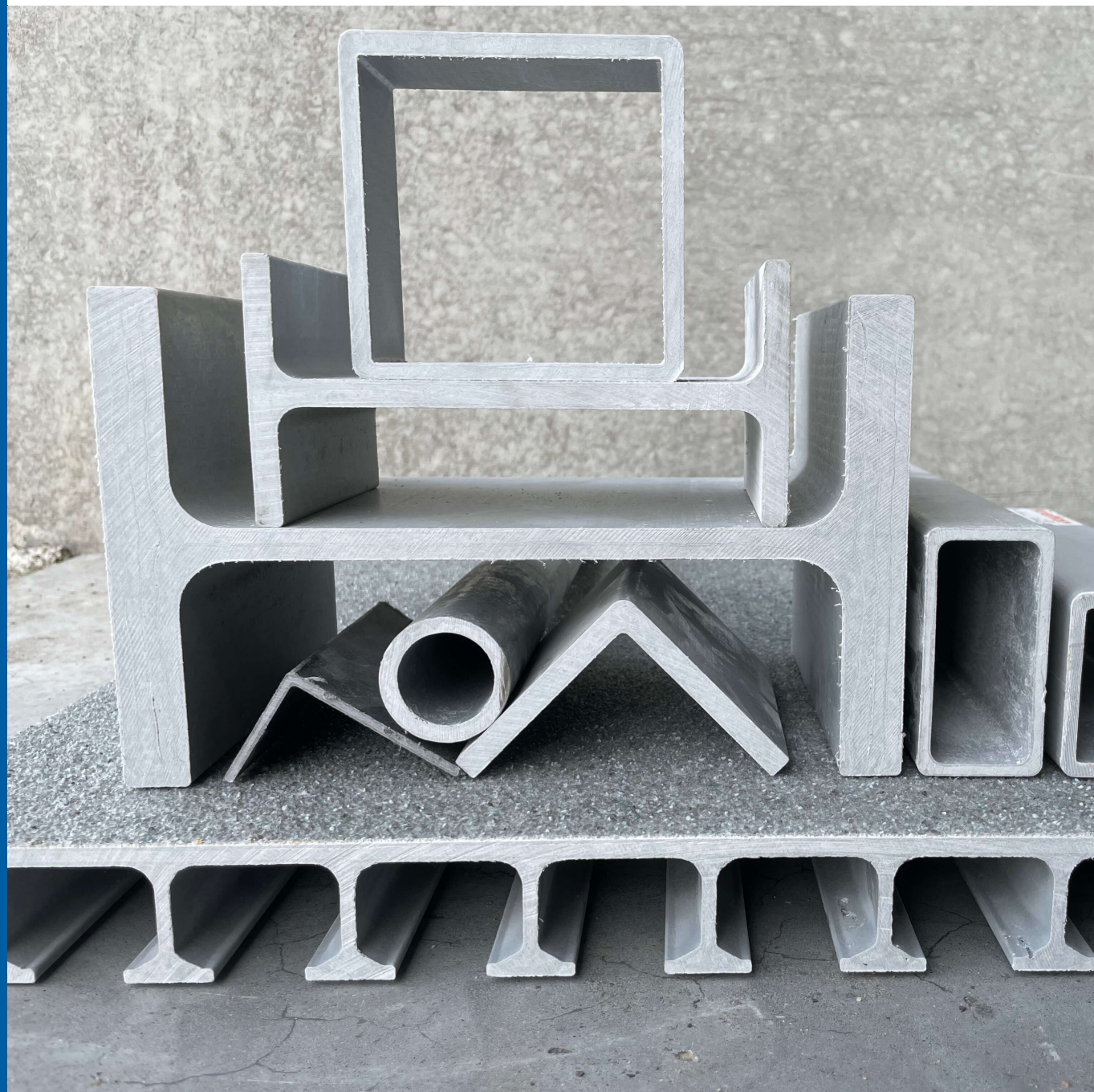
Environmental Product Declaration (EPD)
According to ISO 14025 and EN 15804+A2:2019

krafton® FRP profiles



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Issue date:	03-06-2025
Valid until:	03-06-2030
Declaration owner:	krafton
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Status:	verified

1 General information

1.1 PRODUCT

krafton® FRP profiles

1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-176982-EN

1.3 VALIDITY

Issue date: 03-06-2025

Valid until: 03-06-2030

1.4 PROGRAMME OPERATOR

Kiwa-Ecobility Experts
Wattstraße 11-13
13355 Berlin
DE

Raoul Mancke

(Head of programme operations, Kiwa-Ecobility Experts)

Dr. Ronny Stadie

(Verification body, Kiwa-Ecobility Experts)

1.5 OWNER OF THE DECLARATION

Manufacturer: krafton

Address: Markweg Zuid 34, 4794 SN Heijningen, Netherlands

E-mail: info@krafton.nl

Website: www.krafton.nl

Production location: Production krafton Heijningen

Address production location: Markweg Zuid 34, 4794 SN Heijningen, Netherlands

1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804+A2:2019 serves as the core PCR.

☐ Internal ☒ External

Anne Kees Jeeninga, Advieslab

1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The programme operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

1.8 PRODUCT CATEGORY RULES

Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules (2022-02-14)

1.9 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804+A2:2019. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs

1 General information

and general program instructions of different EPD program operators may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2:2019 and ISO 14025.

1.10 CALCULATION BASIS

LCA method R<THINK: Ecobility Experts | EN15804+A2

LCA software*: Simapro 9.6

Characterization method: R<THINK characterization method (see references for more details)

LCA database profiles: ecoinvent (for version see references)

Version database: v3.19 (20250306)

** Simapro is used for calculating the characterized results of the Environmental profiles within R<THINK.*

1.11 LCA BACKGROUND REPORT

This EPD is generated on the basis of the LCA background report 'krafton® FRP profiles ' with the calculation identifier ReTHiNK-76982.

2 Product

2.1 PRODUCT DESCRIPTION

This concerning a manufaturer specific EPD for krafton® Fiber Reinforced Plastics (FRP) profiles:

The krafton® Fiber Reinforced Plastics (FRP) profiles are lightweight, strong, and corrosion-resistant structural elements made from fiberglass-reinforced plastic. These innovative profiles are designed as a durable alternative to traditional materials like steel, aluminum, or wood in demanding environments.

Key Features:

- Lightweight
- Corrosion Resistant
- High Strength and Rigidity
- Low Maintenance
- Non-Conductive

Available Shapes:

- U-channels
- I-beams
- L-profiles (angle profiles)
- Square and round tubes
- Flat profiles
- handrail profiles

NEN-EN 13706-23
The krafton® FRP profiles and planks have been tested according to the European standard NEN EN 13706 23. This certification assures that the krafton® FRP profiles and planks will perform safely and durably in a variety of applications.

2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

The krafton® FRP profiles set the standard for innovation and versatility. Whether in:

- Offshore
- HVAC
- Transport & Logistics
- construction sector
- Railway Infrastructure and Deutsche Bahn
- Infrastructure/Bridges

The high-qualityhigh-quality krafton® FRP profiles prove themselves time and again in a wide range of applications.

Return Policy:
To ensure the circularity of FRP profiles by krafton®, there is set up a guaranteed return policy. Thanks to this guaranteed return policy, operators can return their FRP profiles when a temporary construction project has ended or when the service life of the FRP profiles are nearing its end.

2.3 REFERENCE SERVICE LIFE

RSL PRODUCT

Based on experience and generally accepted standards, a lifespan of 100 years has been assumed. Composite actually has no known degradation mechanism in the intended application.

As proof krafton® performed a logarithmic creep tensile test on the krafton® plank. This shows that the force required to break the krafton® plank after 100 years is >250% of the maximum allowable load.

USED RSL (YR) IN THIS LCA CALCULATION:

100

RSL PARTS

Based on experience and generally accepted standards, a lifespan of 100 years has been assumed. Composite actually has no known degradation mechanism in the intended application.

As proof krafton® performed a logarithmic creep tensile test on the krafton® plank. This shows that the force required to break the krafton® plank after 100 years is >250% of the maximum allowable load.

2.4 TECHNICAL DATA

- Specific weight kg/m3 : 1.850
- Tensile strength N/mm2: Axial (longitudinal) : 365
    - Transversal (crosswise):
        - laminate thickness <6mm : 105 ;
        - laminate thickness > 7 mm: 48
- Modulus of elasticity GPa :
    - Axial (longitudinal) :
        - laminate thickness 3 and 4 mm : 24.3
        - laminate thickness 5 and 6 mm : 32
        - laminate thicknedd > 7 mm : 36.5
- Thermal conductivity lambda value W/m/oK : Axial (longitudinal) 0.4 ;
    - Transversal (crosswise) 0.25

2 Product

- Coefficient of linear expansion mm/m/100 C :
  - Axial : 1.0 ;
  - Transversal : 3.2
- Barcol Hardness : 50
- Barcol Waterabsortion (Weight percent) : 0.7%

2.5 SUBSTANCES OF VERY HIGH CONCERN

The product is not classifiable as dangerous. This product does not contain any SVHC listed in the REACH Candidate List above 0.1% (w/w).

Information concerning particular hazards for human environment not required.

Classification system
According to EU regulation 1272/2008: No classification

2.6 DESCRIPTION PRODUCTION PROCESS

1. Insertion of the glass fibre reinforcements

The process starts with insertion of the glass fibre reinforcements. Reel winding frames are located at the front of the machine. These frames hold reels of glass fibre thread. Approximately 2.1 kilometres of glass fibre thread, e.g. 9600 TEX, are wound on each reel.

2. Travel through the impregnation bath

The glass fibre threads, and possibly glass fibre matting, pass through the impregnation bath where they are coated with polyester resin. The liquid synthetic resin is mixed with a hardener, colourant, fire retardants and other additives.

3. Travel through the infeed plates

The infeed plates guide the glass fibre threads and mats to the right position in the mould to ensure the correct glass fibre content. The glass fibre threads enhance linear tensile strength and the mats give the material transverse tensile strength. The amount of glass fibre material depends on the profile's design specifications and properties.

4. Travel through the heated mould

Next, the resin, fibres and mats are pulled through a heated mould. The profile is formed and cured in the hot mould. Halfway through the mould, the material is already starting to harden. Once it leaves the mould, it is fully cured and can be subjected to mechanical load. The profile requires no further processing. The mould is made from wear-resistant steel and assembled from several parts. The inside of the mould is chrome-plated. The programmable computer controls all machine operations. This is where the throughput speed, cutting length and the different temperature profiles in the mould's heating system are set. The moulds used by krafton® accommodate a maximum width of 1 metre. We have moulds for all profile types and dimensions, ranging from small bar profiles and angle profiles to wide bridge decking elements. We use our own moulds for the standard profiles. We also design custom moulds for customers. These moulds remain the property of the customer and are used to produce their unique and, in some cases patented, custom profiles on our pultrusion machine.

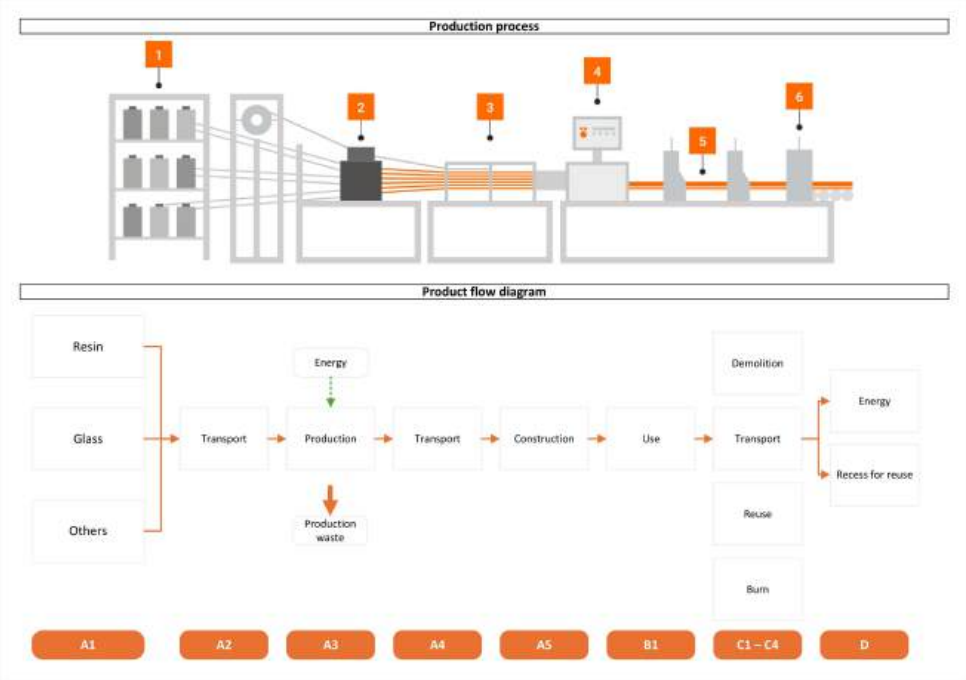
5. Pultrusion of the profile

A dual gripping and pulling system alternately clamps and pulls the profile. The clamps are shaped to exactly match the outside of the profile and are clad with soft plastic to avoid damaging it. Pultrusion is a continuous process with the added advantage of good quality control. The dimensions of the pultrusion profile's cross-section are controlled within tight tolerances. Pultrusion is suitable for all kinds of glass fibres. Different types of fibre can also be combined. As a result, a high fibre content (up to 70% by weight) can be achieved, resulting in high specific stiffness and strength.

6. Cutting the GRP profile to length

The cross-cut saw moves at the line speed and cuts the profile to the desired length. Because the saw moves synchronously with the profile, the saw cut is perfectly perpendicular. A diamond-coated saw blade is used for maximum service life. A dust extractor is fitted to the saw unit.

2 Product



2.7 CONSTRUCTION DESCRIPTION

Glueing

The composite material lends itself well to glueing and painting. Examples of commonly used adhesives: polyurethane single component or 2-component, methacrylate or epoxy adhesive. Other single component adhesives also work well: For example, Sikaflex® PRO-2-HP or equivalent products from other brands.

Filler mastic for long-term UV-resistant joint sealing such as Sikaflex® 84-UV or equivalent products from other brands.
Curing time: longer, several hours up to days

General preparation for glued joints
1. degrease and remove any remaining solvent from the profile
2. sand the surface
3. remove sanding dust
4. degrease
5. apply adhesive in accordance with the supplier's instructions

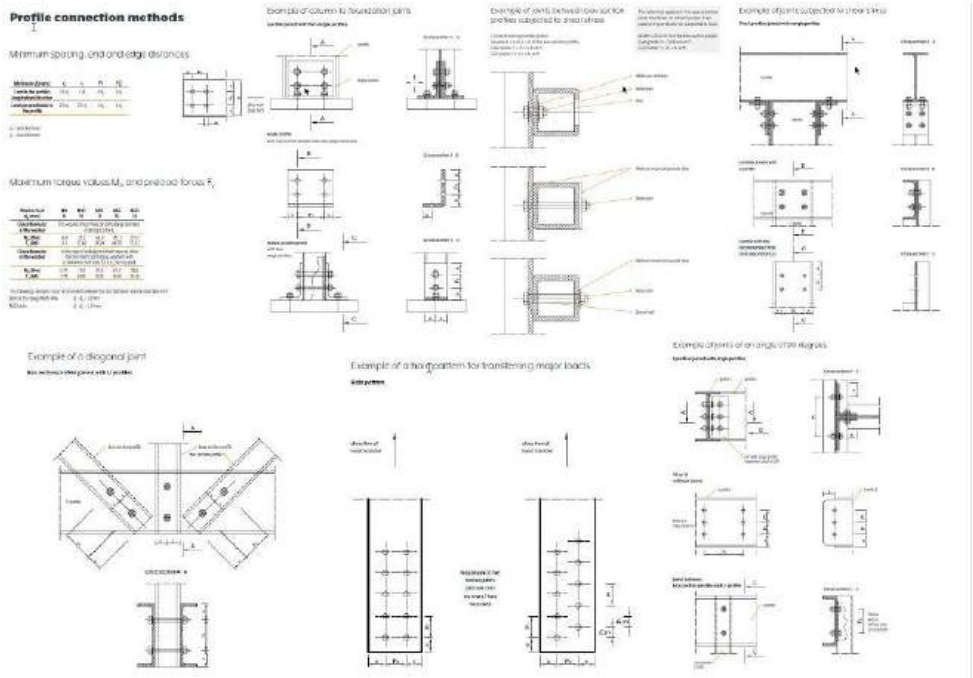
Painting

Paint systems: depending on the application - alkyd resin-bonded paint, alkyd/ polyurethane hybrid, acrylic latex, polyurethane (UV-resistant) or epoxy-based and water-based systems. Ask the paint producer for advice. Surface preparation is similar to that for adhesives.

Adhesives and paints must be applied in dry conditions. Also take the dew point and condensation into account.

Machining operations

When carrying out machining operations, adequate personal protective equipment must always be used. The following must be worn: eye protection, gloves and a breathing mask with the correct dust filter. Use machines with a working dust extraction attachment. Apply resin or a suitable coating to seal cut edges and drilled holes. This prevents the ingress of water and chemicals.



3 Calculation rules

3.1 FUNCTIONAL UNIT

1kg FRP profile

The krafton® Fiber Reinforced Plastics (FRP) profiles are used in a wide range of industries, construction, rail infrastructure, HVAC, etc. and are characterised by excellent mechanical, dynamic and thermal properties. Furthermore, good UV and corrosion resistance and excellent electrical insulation are also important product advantages.

Reference unit: kilogram (kg)

3.2 CONVERSION FACTORS

Description	Value	Unit
Reference unit	1	kg
Conversion factor to 1 kg	1.000000	kg

3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to gate with options, modules C1-C4 and module D EPD. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	ND	ND	ND	ND	X	X	X	X	X

The modules of the EN 15804 contain the following:

Module A1 = Raw material supply	Module B5 = Refurbishment
Module A2 = Transport	Module B6 = Operational energy use
Module A3 = Manufacturing	Module B7 = Operational water use
Module A4 = Transport	Module C1 = De-construction / Demolition
Module A5 = Construction - Installation process	Module C2 = Transport
Module B1 = Use	Module C3 = Waste Processing
Module B2 = Maintenance	Module C4 = Disposal
Module B3 = Repair	Module D = Benefits and loads beyond the product system boundaries
Module B4 = Replacement	

3.4 REPRESENTATIVENESS

This EPD is representative for krafton® FRP profiles , a product of krafton. The results of this EPD are representative for European Union.

3.5 CUT-OFF CRITERIA

Product stage (A1-A3)
All input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. production waste) are considered in this LCA. In the product stage Capital goods and packaging of incoming raw materials are not considered. The total not considered input flows do not exceed the limit of 5% of energy use and mass.

3 Calculation rules

The capital good for krafton®product production process can be estimated from EcoInvent processen for similar processing. The exact process (Pulltrusion) is unfortunately not available in ecoinvent, Instead, the plastic pipe extrusion process was used as a reference.
In this ecoinvent process the steel component for the installation/production equipment is estimated as 0,0012kg steel (low-alloyed) per kg of product that is processed. This steel has an environmental cost indicator (ECI) impact of 8,18E-04 euro per kg of extruded material. The environmental cost indicator (ECI) impact of Krafton FRP profiles are 0.40 euro ECI for A1-A3. So the steel for the equipment would be far below 0,01% of the production impact and far below the cut-off criterium. Therefor is decided to not include the capital good in the calculation, based on this estimation.

Construction process stage (A4-A5)
All input flows (e.g. transportation to the construction site, additional raw material use for construction, installation energy (use)of energy use for assembly , etc.) and output flows (e.g. construction waste, packaging waste, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

In this phase the average distance to all customers in Europe is calculated, whereby the products can be placed manually.

Use stage (B1-B3)
All (known) input flows (e.g. raw materials, transportation, energy use, packaging, etc.) and output flows (e.g. emissions to soil, air and water, construction waste, packaging waste, end-of-life waste, etc.) related to the building fabric are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

End of life stage (C1-C4)
All input flows (e.g. energy use for demolition or disassembly, transport to waste processing, etc.) and output flows (e.g. end-of-life waste processing of the product, etc.) are considered in this LCA. The total neglected input flows do therefore not exceed the limit of 5% of energy use and mass.

Benefits and loads beyond the system boundary (Module D)
All benefits and loads beyond the system boundary resulting from reusable products, recyclable materials and/or useful energy carriers leaving the product system are considered in this LCA.

3.6 ALLOCATION

Allocation has not been applied in this LCA.

3.7 DATA COLLECTION & REFERENCE PERIOD

The product composition and emissions are in accordance with the production method in the year 2022

3.8 ESTIMATES AND ASSUMPTIONS

All emissions and energy consumption data are calculated using data from Krafton van Bijl production. Please refer to the attached Excel table for the calculation method.

There will be undeclared modules from use stage (B1), maintenance (B2), repair (B3) and waste during De-construction / Demolition (C1)

Regarding Use stage:
No material can become loose from the profiles during use

Regarding Maintenance:
No repairs are required to the profiles because they do not wear out

Regarding repair:
No repairs are required to the profiles because they do not wear out

Regarding waste disassembly:
When dismantling the profile construction, all parts can be easily dismantled and reused. for this reason there is also no waste during disassembly.

3.9 DATA QUALITY

Data have been derived form the ERP systeem AFAS. Emissions data have been derived from the Ion Science CUB Instrument.

The foreground data provided by Krafton van Bijl has been established for 2022. The time-related representativeness of the foreground data can be characterized as high (1). For the key background processes (from EcoInvent 3.6), the time-related representativeness is considered to be average (3) to high (1).

All reasonably expected environmental interventions have been quantified, and the completeness can be characterized as good (2).

The LCA study pertains to products intended for the European market. Geographically representative processes have been used for the key processes. The geographic representativeness can be characterized as high (1).

3 Calculation rules

All details have been described to replicate the LCA, and uniformity and consistency are high (1).

There are no aggregated processes. It concerns 1 production location and type of process operation.

3.10 POWER MIX

The residual power mix of the Netherlands was used for electricity. The following ecoinvent profile was used to represent the power mix: *Electricity, low voltage {NL}| electricity, low voltage, residual mix*

This environmental profile holds a GWP-total 0.483 kg CO2 per kWh.

4 Scenarios and additional technical information

4.1 TRANSPORT TO CONSTRUCTION SITE (A4)

For the transport from production place to assembly/user, the following scenario is assumed for module A4 of this EPD.

	Value and unit
Vehicle type used for transport	(ei3.6) Lorry (Truck), unspecified (default) | market group for (GLO)
Fuel type and consumption of vehicle	not available
Distance	200 km
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4.2 ASSEMBLY (A5)

The following information describes the scenarios for flows entering the system and flows leaving the system at module A5.

FLOWS ENTERING THE SYSTEM

There are no significant environment impacts as a result of materials or energy used in the construction stage (A5).

FLOWS LEAVING THE SYSTEM

The following output flows leaving the system at module A5 are assumed.

Description	Value	Unit
Output materials as result of loss during construction	1.5	%
Output materials as result of waste processing of materials used for installation/assembly at the building site	0.000	kg
Output materials as result of waste processing of used packaging	0.008	kg

4.3 USE STAGE (B1)

No significant environment impact in the use stage modules, because there is no (significant) emission to air, soil or water.

4.4 MAINTENANCE (B2)

For maintenance no input or output flows are modelled.

4 Scenarios and additional technical information

4.5 REPAIR (B3)

Repairs are not applicable within the functional unit and to achieve the reference service life.

4.6 DE-CONSTRUCTION, DEMOLITION (C1)

No inputs are needed for the product at the de-construction / demolition phase

4.7 TRANSPORT END-OF-LIFE (C2)

The following distances and transport conveyance are assumed for transportation during end of life for the different types of waste processing.

Waste Scenario	Transport conveyance	Not removed (stays in work) [km]	Landfill [km]	Incineration [km]	Recycling [km]	Re-use [km]
GVK re-use standaard profiel (obv NMD ID 46) EU	(ei3.6) Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	200

The transport conveyance(s) used in the scenario(s) for transport during end of life has the following characteristics.

	Value and unit
Vehicle type used for transport	(ei3.6) Lorry (Truck), unspecified (default) | market group for (GLO)
Fuel type and consumption of vehicle	not available
Capacity utilisation (including empty returns)	50 % (loaded up and return empty)
Bulk density of transported products	inapplicable
Volume capacity utilisation factor	1

4.8 END OF LIFE (C3, C4)

The scenario(s) assumed for end of life of the product are given in the following tables.
First the assumed percentages per type of waste processing are displayed, followed by the assumed amounts.

4 Scenarios and additional technical information

Waste Scenario	Region	Not removed (stays in work) [%]	Landfill [%]	Incineration [%]	Recycling [%]	Re-use [%]
GVK re-use standaard profiel (obv NMD ID 46) EU	NL	0	0	10	0	90

Waste Scenario	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
GVK re-use standaard profiel (obv NMD ID 46) EU	0.000	0.000	0.100	0.000	0.900
Total	**0.000**	**0.000**	**0.100**	**0.000**	**0.900**

4.9 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

The presented Benefits and loads beyond the system boundary in this EPD are based on the following calculated Net output flows in kilograms and Energy recovery displayed in MJ Lower Heating Value.

Waste Scenario	Net output flow [kg]	Energy recovery [MJ]
GVK re-use standaard profiel (obv NMD ID 46) EU	0.000	0.672
Total	**0.000**	**0.672**

5 Results

For the impact assessment long-term emissions (>100 years) are not considered. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

5.1 ENVIRONMENTAL IMPACT INDICATORS PER KILOGRAM

CORE ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	1.95E+0	6.79E-2	1.56E-1	2.18E+0	2.72E-2	5.13E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.63E-2	2.66E-1	0.00E+0	-1.87E+0
GWP-f	kg CO_2 eq.	1.97E+0	6.78E-2	1.69E-1	2.21E+0	2.72E-2	3.87E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.63E-2	2.66E-1	0.00E+0	-1.89E+0
GWP-b	kg CO_2 eq.	-1.54E-2	2.70E-5	-1.26E-2	-2.80E-2	1.10E-5	1.26E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.06E-5	4.51E-5	0.00E+0	2.14E-2
GWP-luluc	kg CO_2 eq.	4.24E-4	1.99E-5	6.04E-5	5.04E-4	9.98E-6	8.35E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.65E-6	2.03E-5	0.00E+0	-4.35E-4
ODP	kg CFC 11 eq.	1.57E-7	1.60E-8	8.71E-9	1.81E-7	6.01E-9	3.10E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.81E-9	8.01E-9	0.00E+0	-1.59E-7
AP	mol H+ eq.	8.61E-3	2.81E-4	4.91E-4	9.38E-3	1.58E-4	1.52E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.53E-4	1.13E-4	0.00E+0	-7.80E-3
EP-fw	kg P eq.	4.23E-5	5.19E-7	5.59E-6	4.84E-5	2.74E-7	7.60E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.65E-7	7.66E-7	0.00E+0	-4.43E-5
EP-m	kg N eq.	1.55E-3	8.34E-5	1.10E-4	1.74E-3	5.56E-5	2.99E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.38E-5	3.10E-5	0.00E+0	-1.45E-3
EP-T	mol N eq.	1.70E-2	9.22E-4	1.37E-3	1.93E-2	6.13E-4	3.31E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.93E-4	3.45E-4	0.00E+0	-1.60E-2
POCP	kg NMVOC eq.	8.10E-3	2.98E-4	1.23E-3	9.63E-3	1.75E-4	1.57E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.69E-4	9.16E-5	0.00E+0	-8.01E-3
ADP-mm	kg Sb-eq.	1.01E-5	1.17E-6	1.59E-6	1.28E-5	6.89E-7	2.24E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.67E-7	3.12E-7	0.00E+0	-1.02E-5
ADP-f	MJ	3.36E+1	1.06E+0	2.26E+0	3.69E+1	4.10E-1	5.78E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.97E-1	1.83E-1	0.00E+0	-3.17E+1
WDP	m3 world eq.	9.38E-1	3.44E-3	2.37E-2	9.65E-1	1.47E-3	1.49E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.42E-3	1.32E-2	0.00E+0	-8.00E-1

GWP-total=Global Warming Potential total (GWP-total) | **GWP-f**=Global Warming Potential fossil fuels (GWP-fossil) | **GWP-b**=Global Warming Potential biogenic (GWP-biogenic) | **GWP-luluc**=Global Warming Potential land use and land use change (GWP-luluc) | **ODP**=Depletion potential of the stratosperic ozon layer (ODP) | **AP**=Acidification potential, Accumulated Exceedance (AP) | **EP-fw**=Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater) | **EP-m**=Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine) | **EP-T**=Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | **POCP**=Formation potential of tropospheric ozone (POCP) | **ADP-mm**=Abiotic depletion potential for non fossil resources (ADP mm) | **ADP-f**=Abiotic depletion for fossil resources potential (ADP fossil) | **WDP**=Water (user) deprication potential, deprivation-weighted water consumption (WDP)

5 Results

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN 15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
PM	disease incidence	5.83E-8	6.12E-9	3.45E-9	6.79E-8	2.44E-9	1.15E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.36E-9	8.49E-10	0.00E+0	-5.57E-8
IR	kBq U235 eq.	1.09E-1	4.62E-3	1.34E-3	1.15E-1	1.72E-3	1.83E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.66E-3	7.78E-4	0.00E+0	-9.79E-2
ETP-fw	CTUe	5.02E+1	8.43E-1	6.34E-1	5.17E+1	3.66E-1	8.53E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.54E-1	3.34E+0	0.00E+0	-4.48E+1
HTP-c	CTUh	2.80E-9	2.07E-11	1.87E-9	4.69E-9	1.19E-11	7.43E-11	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.15E-11	4.86E-11	0.00E+0	-3.89E-9
HTP-nc	CTUh	3.38E-8	9.56E-10	2.30E-9	3.70E-8	4.01E-10	5.99E-10	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.88E-10	1.03E-9	0.00E+0	-3.06E-8
SQP	Pt	1.85E+0	1.21E+0	3.72E+0	6.78E+0	3.56E-1	1.17E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.44E-1	5.62E-2	0.00E+0	-5.12E+0

PM=Potential incidence of disease due to PM emissions (PM) | **IR**=Potential Human exposure efficiency relative to U235 (IRP) | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems (ETP-fw) | **HTP-c**=Potential Comparative Toxic Unit for humans (HTP-c) | **HTP-nc**=Potential Comparative Toxic Unit for humans (HTP-nc) | **SQP**=Potential soil quality idex (SQP)

CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2

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ILCD classification	Indicator	Disclaimer
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

5.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

PARAMETERS DESCRIBING RESOURCE USE

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
PERE	MJ	7.78E-1	1.33E-2	8.45E-1	1.64E+0	5.14E-3	2.53E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.97E-3	1.99E-2	0.00E+0	-1.12E+0
PERM	MJ	0.00E+0	0.00E+0	1.06E-1	1.06E-1	0.00E+0	1.61E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-8.84E-2
PERT	MJ	7.78E-1	1.33E-2	9.51E-1	1.74E+0	5.14E-3	2.69E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.97E-3	1.99E-2	0.00E+0	-1.20E+0
PENRE	MJ	2.96E+1	1.12E+0	2.30E+0	3.30E+1	4.36E-1	5.21E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.21E-1	1.95E-1	0.00E+0	-2.85E+1
PENRM	MJ	6.72E+0	0.00E+0	1.83E-2	6.74E+0	0.00E+0	1.02E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.73E+0
PENRT	MJ	3.63E+1	1.12E+0	2.31E+0	3.98E+1	4.36E-1	6.23E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.21E-1	1.95E-1	0.00E+0	-3.43E+1
SM	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m^3	2.30E-2	1.21E-4	1.36E-3	2.45E-2	5.00E-5	3.84E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.84E-5	3.88E-4	0.00E+0	-2.05E-2

PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | **PERM**=Use of renewable primary energy resources used as raw materials | **PERT**=Total use of renewable primary energy resources | **PENRE**=Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | **PENRM**=Use of non-renewable primary energy resources used as raw materials | **PENRT**=Total use of non-renewable primary energy resources | **SM**=Use of secondary material | **RSF**=Use of renewable secondary fuels | **NRSF**=Use of non-renewable secondary fuels | **FW**=Net use of fresh water

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OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
HWD	Kg	3.15E-5	2.57E-6	9.39E-6	4.35E-5	1.04E-6	7.03E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.01E-6	3.57E-7	0.00E+0	-3.07E-5
NHWD	Kg	9.97E-1	9.18E-2	1.33E-2	1.10E+0	2.60E-2	2.67E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.52E-2	1.04E-1	0.00E+0	-8.96E-1
RWD	Kg	2.47E-5	7.22E-6	9.94E-7	3.29E-5	2.70E-6	6.08E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.61E-6	6.53E-7	0.00E+0	-3.14E-5

HWD=Hazardous waste disposed | **NHWD**=Non-hazardous waste disposed | **RWD**=Radioactive waste disposed

ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

Abbr.	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.90E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	3.09E-3	3.09E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.38E-1
EEE	MJ	0.00E+0	0.00E+0	1.79E-3	1.79E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.38E-1

CRU=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy, Thermic | **EEE**=Exported Energy, Electric

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5.3 INFORMATION ON BIOGENIC CARBON CONTENT PER KILOGRAM

BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per kilogram:

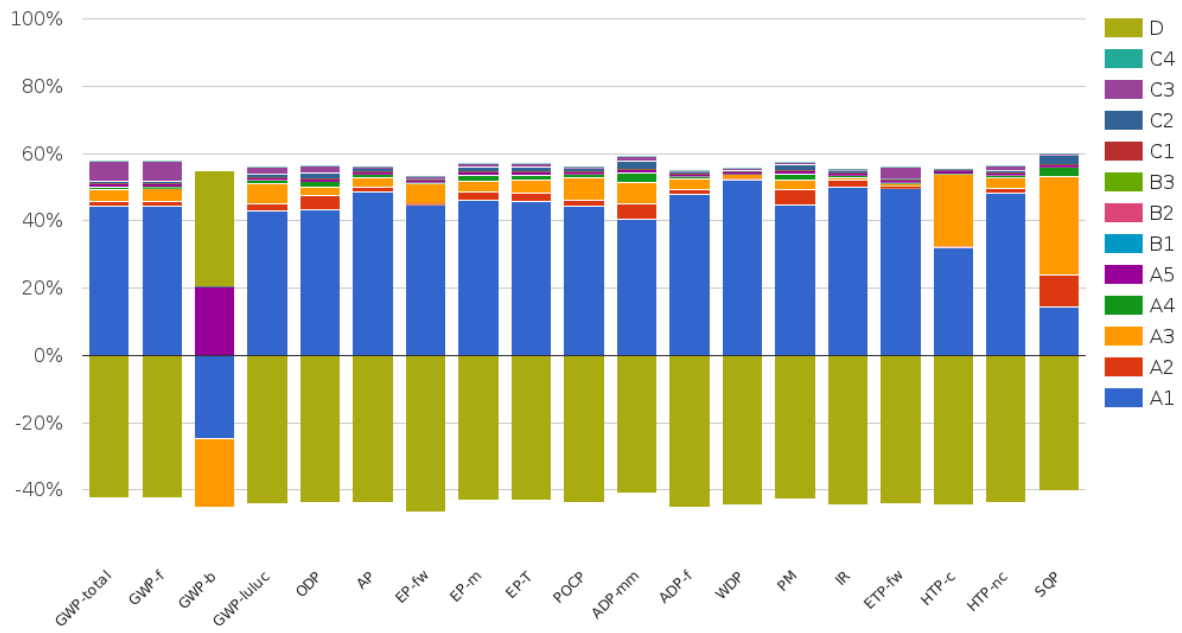
Biogenic carbon content	Amount	Unit
Biogenic carbon content in the product	0	kg C
Biogenic carbon content in accompanying packaging	0.003491	kg C

UPTAKE OF BIOGENIC CARBON DIOXIDE

The following amount of carbon dioxide uptake is taken into account. Related uptake and release of carbon dioxide in downstream processes are not taken into account in this number although they do appear in the presented results. One kilogram of biogenic Carbon content is equivalent to 44/12 kg of biogenic carbon dioxide uptake.

Uptake Biogenic Carbon dioxide	Amount	Unit
Packaging	0.0128	kg CO2 (biogenic)

6 Interpretation of results



The ratio between de most important modules is as expected. Because of re-use EOL scenario and the Q-factor of 90% we see in module D an avoided impact that is equal to about 80% of module A1-A3. For certain environmental effects the contributions in module A4-C4 are higher, these are not avoided and then the balance of module D/A1-A3 is lsight lower.

For Biogenic GWP the balance is different. There are no biogenic raw materials in our product, so the GWP-b contributions are all chain effects and they ar small. no effort has been done to track and explain these impacts. GWP-b is less then 0.1% of GWP total and thus neglected.

7 References

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EN 15804+A2
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NMD Determination method
NMD Determination method Environmental performance Construction works v1.1 March 2022, foundation NMD

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