Environmental Product Declaration

according to ISO 14025 and EN 15804

MRPI
milieu relevante product informatie

This declaration is for:
EcoSheetPiles™

Provided by:
ArcelorMittal Projects Europe

ArcelorMittal

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ECO PLATFORM EPD EN 15804 VERIFIED

COMPANY INFORMATION

Mannesmannweg 5
4793 SL
Heijningen
0031 (0)88-0083700
projects.europe@arcelormittal.com
www.arcelormittal.com/foundationsolutions

MRPI® REGISTRATION

1.1.00196.2021

DATE OF ISSUE

19-02-2021

EXPIRY DATE

19-02-2026

PRODUCT

EcoSheetPiles

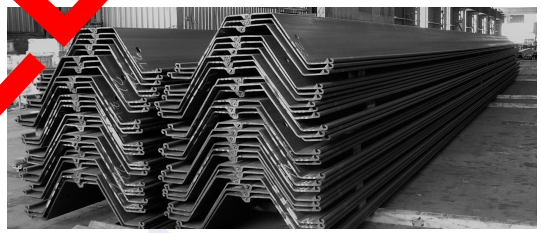
DECLARED UNIT/FUNCTIONAL UNIT

1 metric ton

DESCRIPTION OF PRODUCT

Steel sheet piling are rolled steel profiles with longitudinal clutches at each side. Sheet piles can be connected to each allowing construction of a continuous wall.

VISUAL PRODUCT



MORE INFORMATION

www.arcelormittal.com/foundationsolutions

SCOPE OF DECLARATION

This MRPI®-EPD certificate is verified by **Ulbert Hofstra , SGS Search / Intron.**
The LCA study has been done by **Kamiel Jansen, Primum.**
The certificate is based on an LCA-dossier according to ISO14025 and EN15804+A2 (incl. A1). It is verified according to the <u>MRPI®-EPD verification protocol November 2020.v4.0'</u>. EPDs of construction products may not be comparable if they do not comply with EN15804+A2 (incl. A1). Declaration of SVHC that are listed on the 'Candidate List of Substances of Very High Concern for authorisation' when content exceeds the limits for registration with ECHA.

PROGRAM OPERATOR

Stichting MRPI®
Kingsfordweg 151
1043GR
Amsterdam

ir. J-P den Hollander, Managing director MRPI®

DEMONSTRATION OF VERIFICATION
CEN standard EN15804 serves as the core PCR[a]
Independent verification of the declaration and data, according to EN ISO 14025:2010: internal: external: X
Third party verifier: Ulbert Hofstra, SGS Intron B.V.
[a] PCR = Product Category Rules

DETAILED PRODUCT DESCRIPTION

Product description / Product definition

Steel sheet piling are rolled steel profiles with longitudinal clutches at each side. Sheet piles can be connected to eachother through these clutches creating a mechanical connection (i.e. interlock) between the profiles allowing the construction of a continuous wall.

This EPD applies to 1 metric ton of EcoSheetPiles™. EcoSheetPiles™ are produced at the ArcelorMittal sites Differdange/Esch-Belval in Luxembourg from ca. 100% scrap in an electric arc furnace route and are 100% reusable and recyclable. The types of EcoSheetPiles available are: Z-shaped, U-shaped, straight-web, and H-shaped.

Application

Sheet pile walls resist to high pressure and can support massive height of soil with a small quantity of steel compared to the applied loads. Steel piling products are used worldwide in many kinds of permanent or temporary structures: quay walls and breakwaters in harbors and locks, bank reinforcement on rivers and canals, pumping stations, bridge abutments, retaining walls for underpasses or underground car parks, impervious containment walls, temporary cofferdams in land and in water, containment barriers, and load bearing foundations among others.

Technical Data

This EPD is valid for EcoSheetPiles™ steel piling products of varied grades and geometries, as well as different forms of delivery. Specific information on dimension tolerances, constructional data and mechanical and chemical properties can be found in the relevant standards /EN 10248/.

Reference service life

A reference service life for steel piling products is not declared. The documentation of the RSL is not required for the EPD of ArcelorMittal since not the entire life cycle is declared (only modules A1-A3, B1-B5, C2, C3, C4 and D). Steel piling products are construction products used in many different applications and can differ in service life. The service life of the steel can go up to 100 years or more, depending on the design of the project.

Components

Iron is the main component of steel piling products. Alloying elements are added in the form of ferroalloys or metal, the most common elements are manganese, chromium and vanadium. Other elements like nitrogen or copper may be present in the steel. The composition of these elements depends on the steel designation/grade.

COMPONENT (> 1%)	[kg / %]
Steel made from secondary sources (scrap, EAF process)	> 96 %
Manganese is introduced in the form of ferroalloy.	up to 1.7%

(*) > 1% of total mass

SCOPE AND TYPE

The sheetpiles are produced at the location ArcelorMittal Differdange and Esch-Belval and they are applied to the Dutch market. The prescribed waste scenarios from the "SBK Bepalingsmethode v3.0 incl. amendments July 2019, Jan 2020" have been used for the various materials in the product.

The background database is EcoInvent version 3.5. It is a specific EPD for a specific product. The declaration applies to 1 metric ton of EcoSheetPiles™. It covers hot rolled steel sheet piling (Z-shaped, U-shaped, straight-web, and H-shaped) produced by ArcelorMittal.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE								END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport gate to site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
x	x	x	ND	ND	x	x	x	x			ND	ND	x	x	x	x

X = Modules Assessed

ND = Not Declared

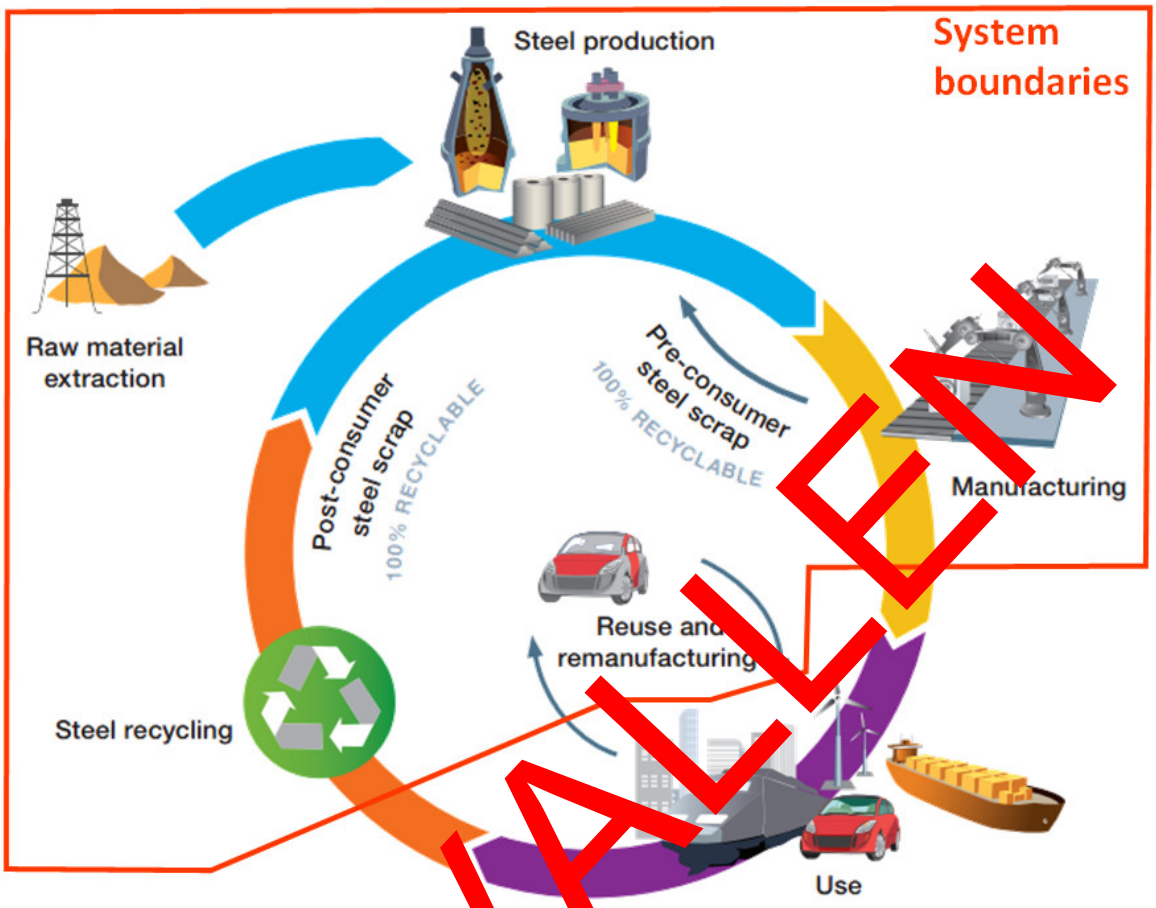


Figure LCA process diagram according to EN 15804(7.2.1)

REPRESENTATIVENESS

The input data are representative for EcoSheetPiles™, a product of ArcelorMittal. The data are representative for the Netherlands.

ENVIRONMENTAL IMPACT per functional unit or declared unit (indicators A1)

	UNIT	A1-A3	B1	B2	B3	B4	B5	C2	C3	C4	D
ADPE	[kg Sb eq.]	1.06 E-3	0.00	0.00	0.00	0.00	0.00	1.04 E-5	2.61 E-4	0.00	-4.87 E-6
ADPF	[MJ]	6.49 E+3	0.00	0.00	0.00	0.00	0.00	6.52 E+1	2.34 E+2	0.00	-3.13 E+2
GWP	[kg CO2 eq.]	4.29 E+2	0.00	0.00	0.00	0.00	0.00	3.64 E+0	1.50 E+1	0.00	-2.26 E+1
ODP	[kg CFC11 eq.]	5.89 E-5	0.00	0.00	0.00	0.00	0.00	6.80 E-7	1.78	0.0	-6.63 E-7
POCP	[kg ethene eq.]	2.44 E-1	0.00	0.00	0.00	0.00	0.00	2.16 E-	E-2	0.00	1.18 E-2
AP	[kg SO2 eq.]	1.45 E+0	0.00	0.00	0.00	0.00	0.00	8 E-2	1.30 E-1	00	-5.46 E-2
EP	[kg (PO4)3- eq.]	2.86 E-1	0.00	0.00	0.00	0.00	0.00	18 E	2.78 E-2	0.00	-8.14 E-3

Toxicity indicators and ECI (Dutch market)

HTP	[kg DCB-Eq]	1.40 E+2	0.00	0.00	0.00	0.00	0.0	1.49 E+	1.43 E+1	0.00	-4.91 E+0
FAETP	[kg DCB-Eq]	2.88 E+0	0.00	0.00	0.00	00	0.00	34 E-2	2.00 E-1	0.00	-7.54 E-2
MAETP	[kg DCB-Eq]	7.34 E+3	0.00	0.00	0.00	0.00	0.0	1.55 E+2	1.21 E+3	0.00	-2.29 E+2
TETP	[kg DCB-Eq]	1.90 E+0	0.00	0.00	0.0	.0	0.00	5.15 E-3	4.68 E-2	0.00	-1.04 E-2
ECI	[euro]	4.42 E+1	0.00	0.00	0.00	0.00	0.00	4.34 E-1	2.98 E+0	0.00	-1.93 E+0
ADPF	[kg Sb eq.]	2.71 E+0	0.0	0.00	0.00	0.00	0.00	2.73 E-2	9.79 E-2	0.00	-1.31 E-1

ADPE = Abiotic Depletion Potential for non sources
ADPF = Abiotic Depletion Potential for fossil resources
GWP = Global Warming Potential
ODP = Depletion potential of the stratospheric ozone layer
POCP = Formation potential of tropospheric ozone photochemical oxidants
AP = Acidification Potential, land and water
EP = Eutrophication Potential
HTP = Human Toxicity Potential
FAETP = Fresh water aquatic ecotoxicity potential
MAETP = Marine aquatic ecotoxicity potential
TETP = Terrestrial ecotoxicity potential
ECI = Environmental Cost Indicator
ADPF = Abiotic Depletion Potential for fossil resources expressed in [kg Sb-eq.]
ND = Not Declared

RESOURCE USE per functional unit or declared unit (A1 / A2)

	UNIT	A1-A3	B1	B2	B3	B4	B5	C2	C3	C4	D
PERE	[MJ]	4.03 E+0	0.00	0.00	0.00	0.00	0.00	0.00	3.02 E+1	0.00	-8.34 E+0
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	7.61 E+2	0.00	0.00	0.00	0.00	0.00	5.96 E-1	0.00	0.00	0.00
PENRE	[MJ]	2.36 E+1	0.00	0.00	0.00	0.00	0.00	0.00	2.20 E+2	0.00	-9.32 E+1
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	1.07 E+4	0.00	0.00	0.00	0.00	0.00	6.05 E	2.2 E+2	0.00	-9.32 E+1
SM	[kg]	1.29 E+3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-7.76 E+0
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00
NRSF	[MJ}	0.00	0.00	0.00	0.00	0.00	00	0.00	0.00	0.00	0.00
FW	[m3]	3.98 E+0	0.00	0.00	0.00	0.00	0.00	9.6 3	6.57 E-2	0.00	-3.12 E-2

PERE = Use of renewable energy excluding renewable primary energy resou s
PERM = Use of renewable energy resources used as raw materials
PERT = Total use of renewable primary energy resources
PENRE = Use of non-renewable primary energy resources excludi non-re ble energy resources used as raw materials
PENRM = Use of non-renewable primary energy resources used as r w m terials
PENRT = Total use of non-renewable primary energy resou es
SM = Use of secondary materials
RSF = Use of renewable secondary fuels
NRSF = Use of non renewable secondary fuels
FW = Use of net fresh water
ND = Not Declared

OUTPUT FLOWS AND WASTE CATEGORIES per functional unit or declared unit (A1 / A2)

	UNIT	A1	B	B2	B3	B4	B5	C2	C3	C4	D
HWD	g]	7.72 E-3	0.00	0.00	0.00	0.00	0.00	3.62 E-5	2.50 E-4	0.00	-2.01 E-4
NHWD	[kg]	E+1	0.00	0.00	0.00	0.00	0.00	3.46 E+0	6.00 E+0	0.00	-1.07 E+0
RWD	kg]	9.38 E-2	0.00	0.00	0.00	0.00	0.00	3.83 E-4	1.19 E-3	0.00	-3.21 E-4
CRU	[kg]	9.88 E+1	0.00	0.00	0.00	0.00	0.00	0.00	5.44 E+2	0.00	0.00
MFR	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

HWD = Hazardous Waste Disposed
NHWD = Non Hazardous Waste Disposed
RWD = Radioactive Waste Disposed
CRU = Components for reuse
MFR = Materials for recycling
MER = Materials for energy recovery
EEE = Exported Electrical Energy
ETE = Exported Thermal Energy
ND = Not Declared

CALCULATION RULES

In the Life cycle assessment the following is included in this study:

Production (A1-A3)

Modules A1-A3 of the EcoSheetPiles™ production include the following:

- The provision of resources, additives, and energy;
- Transport of resources and additives to the production site;
- Production processes on-site including energy;
- Production of additives, disposal of production residues, and consideration of related emissions;
- Recycling of production/manufacturing scrap. Steel scrap is assumed to reach the end-of-waste status once it is shredded and sorted, thus becomes input to the product system in the inventory.

Construction (A4-A5)

Because transport can differ per location, it has not been included in the LCA. A4 can be calculated in accordance with the values in the remarks specified for a tonkm. The equipment needed during the construction phase (A5) is not within ArcelorMittal's sphere of influence and can differ greatly per location and implementation technique. Therefore, this phase has not been included. The contractors can determine this themselves on the basis of project data.

Use stage (B1-B5)

This stage consists of the impacts arising from components of the building and construction works during their use.

Demolition phase (C1)

The equipment needed during the demolition phase is not within ArcelorMittal's sphere of influence and can differ greatly per location and extraction technique. Therefore, this phase has not been included. The contractors can determine this themselves based on project data.

End-of-life stage (C2-C4)

This EPD includes the necessary transport (C2) from the demolition site to the sorting location and/or distance to final disposal. The end-of-life stage includes the final disposal to landfill (C4), incineration (C3) and necessary recycling processes up to the end-of-waste point (C3). Loads and benefits of recycling, reuse and exported energy are part of module D. The prescribed waste scenarios from the SBK Bepalingsmethode v3.0 incl. amendments July 2019, Jan 2020 have been used for the various materials in the product.

Supplementary information outside the building life cycle (D)

This stage contains the potential loads and benefits of recycling and reuse of raw materials/products. The loads contain the necessary recycling processes from end-of-waste-point up to the point-of-equivalence of the substituted primary raw material, and a load for secondary material that will be lost at the end-of-life stage. The loads and benefits of recycling and reuse are included in this module. The benefits are calculated based on the primary content and the primary equivalent. After collection, the needed external scrap in the steel converter is fed back into the production. The recycling potential is then calculated considering the net scrap.

End-of-waste point (in accordance with the steel federation waste profile March 2020)
The iron or steel scrap is segregated at the source or while collecting and is been kept separate; or the input waste is treated to separate the iron and steel scrap from the non-metal and nonferrous components. All mechanical treatment (like cutting, shearing, shredding or granulating; sorting, separating, cleaning, de-polluting, emptying) needed to prepare the material for direct input into final use, has been completed. [End-of-waste Criteria for Iron and Steel Scrap: Technical Proposals, Publications Office of the European Union, 2010]

Allocation in the foreground data
Steel production generates a number of co-products that are sold to and used by other industries. These include mainly slags from either Blast Furnace - Basix Oxygen Furnace or Electric Arc Furnace. The processes that produce these co-products cannot be further subdivided into sub-processes related to each co-product, so allocation is required.

The allocation method used here was developed by the World Steel Association and EUROFER to be in line with CEN EN 15804 /EN 15804/. The methodology is based on physical allocation and takes into account which changes in inputs and outputs affect the production of co-products. The method also takes account of material flows that carry specific inherent properties. This method is deemed to provide the most representative partitioning of the processes involved. Economic allocation was considered, as slag is considered a low-value co-product under EN 15804. However, as neither hot metal nor slag are tradable products upon leaving the blast furnace, economic allocation would most likely be based on estimates. World Steel Association in 2014: A methodology to determine the LCI of steel industry co-products.

Cut-off criteria
Measurement of on-site emissions were performed by ArcelorMittal and those emissions were considered. The specific emissions that are linked to the provision of thermal and electrical energy are also considered in the specific processes. All reported data were incorporated and modelled using the best available LCI data. Data for the sites were cross-checked with one another to identify potential data gaps. No processes, materials or emissions that are known to make a significant contribution to the environmental impact of the studied products have been omitted. On this basis, there is no evidence to suggest that input or output contributing more than 1% to the overall mass or energy of the system - or that are environmentally significant - have been omitted. It can be assumed that all excluded flows contribute less than 5% to the impact assessment categories. Packaging materials and its transportation are neglected due to low contribution to the overall life cycle results.

Assumptions and approximations
In this study, primary data was used to model all on-site processes. This data was cross-checked to identify and eliminate data gaps. Secondary data (from the Ecoinvent database) was as technologically and geographically representative as possible.

Data quality
The foreground data collected by the manufacturer are based on yearly production amounts and extrapolations of measurements on specific machines and plants. The production data refer to the year 2014. Tonnage data refer to the year 2015. Most of the necessary life cycle inventories for the basic materials are available in the Ecoinvent database. Data of the waste profiles are from the NMD (October 2020).

SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

Transport (A4)

The transport distance to the construction site can differ per project. The ECI Environmental Cost Indicator (ECI) or in Dutch Milieu Kosten Indicator (MKI) can be determined by calculating the transport distance between factory and construction site. The transport distance must be multiplied by the following MKI values per ton-km:
Euro 6 truck > lorry: 0,00891 MKI;
Inland vessel: 0,005579175 MKI.

Construction (A5) and demolition (C1) phase

The equipment used in the construction phases (A5) and the demolition phase (C1) are not within ArcelorMittal's sphere of influence and can differ greatly per location and implementation/extraction technique. For this reason, these phases have not been included. These values must be entered project-specifically based on the actual use of equipment.

End-of-life phase (C2-C4) and module D

The end-of-life phases for this EPD are in accordance with the steel federation waste profiles (March 2020) for "heavy steel" (51% reuse and 49% recycling). Because the end of life can vary in projects, the following end-of-life scenarios have been calculated:
- 100% reuse;
- 100% recycling;
- 100% landfill;
- 25% reuse, 74% recycling, 1% landfill

Assumptions Reuse:

Transport (C2) is allocated to the next product. Environmental benefits for reuse are included. The quality factor for reuse is 1/8. The portion that cannot be reused (1/8) is recycled.

Assumptions Recycling:

Transport (C2) and the processing to scrap for the next life cycle (C3) are included.

Assumptions landfill:

Different end-of-life scenarios are used for corrosion and/or in case of sheet piling remaining in the ground. The processes for C2, C3 and C4 are included, but have no value. Module D does have a value because raw materials are lost from the chain, for which compensation has to be made.

The results of the different end-of-life stages (C2-D) are as follows:

Waste scenario	MKI C2	MKI C3	MKI C4	MKI D	MKI total EoL phase C2-4 and D
100% reuse	0.10	0.66	0.00	-38.68	-37.93
100% recycling	0.78	5.26	0.00	-2.03	4.01
100% landfill	0.00	0.00	0.73	137.99	138.72
25% reuse,74% recycling,1% landfill	0.60	4.06	0.01	-9.80	-5.13

A project-specific end-of-life scenario can be calculated by multiplication of the MKI of the actual ratios between reuse, recycling and landfill, as declared in the table above. The standard waste

scenario from the NMD is based on the waste scenario: Steel, heavy I Steel federation NL. This is in accordance with the NMD, because this waste scenario is in many cases prescribed in the tenders. The waste profile of the steel federation makes use of standard profiles for heavy steel products, for which the profile is used: "Steel, Heavy Construction Products (beams, columns, piles)" [Steel federation NL]). The end-of-life scenario of this pre-legitimisation is on basis of a steel sheet pile from ArcelorMittal (A1-3) from this LCA, which creates differences in the results and are therefore more specific.

DECLARATION OF SVHC

No substances listed on the "Candidate List of Substances of Very High Co[illegible]for Autho[illegible]ation" by the European Chemicals Agency EC 1907-2006 are contained in the ste[illegible] in de[illegible]larable quantities.

REFERENCES

ISO 14040

- ISO 14040:2006-10, Environmental management - Life cycle assessme[illegible]t - P[illegible]inciples and framework; EN ISO 14040:2006

ISO 14044

- ISO 14044:2006-10, Environmental management - Life cycle as[illegible]ssment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025

- ISO 14025:2011-10: Environmental labels [illegible]declaratio[illegible]– Type III environmental declarations — Principles and procedures

EN 15804

- EN 15804:2012-04+A1 2013: Sustain[illegible]bility of [illegible]onstruction works — Environmental Product Declarations — Core rules for the produc[illegible]categor[illegible]y of construction products

SBK-verification protocol

- SBK-verification protoc[illegible]– I[illegible]lusion data[illegible] the Dutch environmental database, Final Version 3.0, January 2019, SBK

SBK-Assessment Me[illegible]od

- Assessment M[illegible]thod En[illegible]ronmental Performance Construction and Civil Engineering Works (GWW), Version "3.0 [illegible]anuary 2019" [illegible]l. amendments July 2019, Jan 2020, SBK

Protocol E[illegible]D-onli[illegible]

- 25011[illegible]6.03[illegible]5 - Prot[illegible]ol EPD online - NMD, version 1.2, November 2016, NIBE

EPD Eco[illegible]eetpile[illegible]tn[illegible]

- ArcelorMi[illegible]al, declaration number: EPD-ARM-20180069-IBD1-EN

Back[illegible]ound [illegible]eport:

- MRPI EPD of ArcelorMittal construction steel products - EcoSheetPiles™ , Thinkstep, 19 June 2020

REMARKS

None