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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Ferrometall AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-1730-708-EN
Registration number:	NEPD-1730-708-EN
ECO Platform reference number:	00000869
Issue date:	18.03.2019
Valid to:	18.03.2024

Steel sheet piles

Ferrometall AS
www.epd-norge.no

General information

Product:
Steel sheet piles made from hot rolled steel.

Variability between products are less than 10%.

Owner of the declaration:
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Declaration number:
NEPD-1730-708-EN

Place of production:
Steel is manufactured in Liangong, China (A1).
Storage and delivery to site from Horten, Norway (A3).

ECO Platform reference number:
00000869

Management system:
-

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR 013 Steel as Construction Material Rev 1 (08/2013)
NPCR Construction products and services – Part A

Supplementary PCRs:
NPCR 013 Part B (out for consultation as of 03/2019)

Organisation no:
995 727 064

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Issue date:
18.03.2019

Valid to:
18.03.2024

Declared unit
-

Year of study:
2018

Declared unit with option (A1-A4, C1-C4, D):
Per kg steel (1 kg of steel sheet pile)

Comparability:
EPD of construction products may not be comparable if they do not comply with EN 15804 and are seen in a building context.

Functional unit:
-

The EPD has been worked out by:
Michael Myrvold Jenssen, Asplan Viak AS

asplan viak

Verification:
The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☑ external

Third party verifier:

(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:

Steel sheet piles are interlocking sections of steel sheets piled into the ground to keep loose masses out of the excavation site and to secure nearby construction elements. In addition to retaining walls, sheet piles are commonly used in structures such as basements, protecting riverbanks, quay walls, port structures, construction in water (cofferdams) and so forth. As most construction steel, steel sheet piles are fully recyclable. The product can be also be reused directly; temporary constructions, which lasts up to 3-5 years, can be reused several times without losing their inherent properties.

The specific steel sheet piling in this EPD is produced in China. The products are made of hot rolled sections, shaped to so-called U-profiles and Z-profiles. The products are delivered in varying dimensions, and are delivered according to EN 10025 for construction steel with the product based on EN10248-1/2. Steel grades are S270GP, S355GP, S390GP, and S430GP.

World Steel Association data for rolled steel sections (Asia) is used for A1. Recycled input used in the study is 43%.

Product specification:

Product compostion (avg.) for hot rolled steel sheet piles is given below:

	Iron (Fe)	Carbon (C)	Silicon (Si)	Mangenese (Mn)	Phosphorus (P)	Sulfur (S)	Copper (Cu)	Chromium (Cr)	Nickel (Ni)	Molybdenum (Mo)	Vanadium (V)	Nitrogen (N)
kg	>0,95	2,40E-03	2,40E-03	1,35E-02	1,20E-04	8,00E-05	8,00E-05	6,20E-04	1,20E-04	1,10E-04	5,00E-05	4,00E-05
%	>95	0,24	0,24	1,35	1,20E-02	8,38E-03	8,00E-03	6,24E-02	1,15E-02	1,05E-02	4,63E-03	4,00E-03

Market:

Norway

Reference service life, product:

Not relevant for a cradle-to-gate study where use-phase is not declared (NPCR Part A 6.3.3.).

LCA: Calculation rules

Declared unit:

1 kg of steel sheet pile

System boundary:

Cradle to gate with options (A1-A4, C1-C4, D):

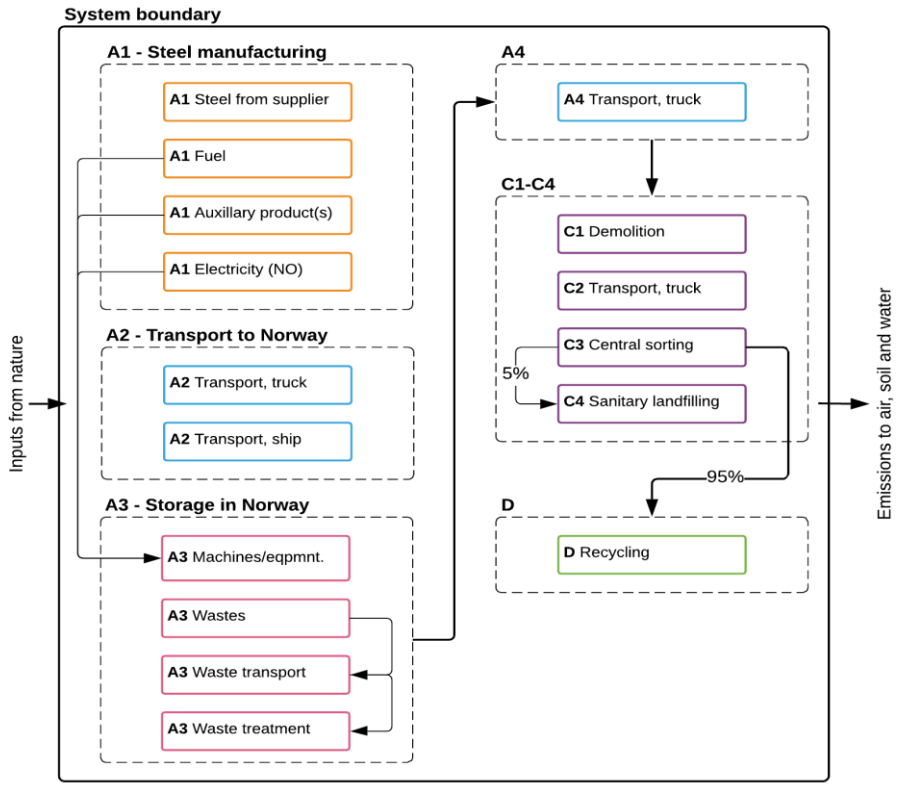

Figure 1: Flowchart showing the system boundaries (A1-A3).

Data quality:
General requirements and guidelines concerning use of generic and specific data and the quality of those are as described in EN 15804: 2012+A1:2013, clause 6.3.6 and 6.3.7. The data is representative according to temporal, geographical and technological requirements. Databases used have been ecoinvent v3.4 and World Steel Association LCI data which is found in the Industry data 2.0 ecoinvent extension (See also Worldsteel, 2017). Calculations have been carried out using Simapro v8.5.

Temporal
Data for use in module A3 is supplied by the manufacturer and consists of recorded and calculated amounts of specific material and energy consumption for the site. Specific data has been collected for 2018. Generic data has been created or updated within the last 10 years. Any exceptions are documented in the LCA-report.

Geographical
The geographic region of the site included in the calculation is Norway (A3 - storage). Region specific worldsteel LCIs are used to model the raw material supply (A1).

Technological
Data represents technology in use.

Cut-off criteria:
All major raw materials and all the essential energy is included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

Allocation:
Incoming energy and water and waste production in-house is allocated following EN 15804 and is distributed equally among all products through mass allocation. Worldsteel LCIs used are not fully compliant with EN15804 because allocation has been avoided by system expansion for some steelmaking co-products (see Worldsteel (2017) for a justification for this deviation). A sensitivity analysis provided by worldsteel (2017) shows that the use of system expansion does not greatly affect the chosen impact parameters; GWP increases 3%-7% depending on the steel type, while primary energy demand is reduced somewhat. In this study, a very small positive ODP result in module D is caused by this allocation approach.

LCA: Scenarios and additional technical information

The following information describe scenarios that currently are in use and are representative for the most likely alternatives.

Transportation scenarios

The scenario for transport distances and transportation modes from supplier to port in Norway represents both recorded and calculated routes and distances. Transport in A2 describes the transport of steel sheet piles from gate in China to port in Norway. Transportation scenarios for waste are based on distances provided by Avfall Norge (Raadal et al., 2009). For an estimation of impacts for other distances to site than the one provided in A4, please use the transport calculator provided by Østfoldforskning AS on behalf of EPD-Norway. It can be found here: https://lca.no/transportkalkulator/

Capacity utlization has been calculated by dividing the average load by the maximum load as they are reported in ecoinvent v3.4. Fuel consumption as given in ecoinvent v3.4. Load factor as reported by ecoinvent.

End of life scenario
A 95% recycling rate has been provided by Worldsteel (Avery, 2019). Only recycling rate and loss to landfill (5%) is considered as a conservative scenario in this EPD, leaving 0% to reuse. In reality, steel recovery rates (recycling and reuse) varies, and can reach up to 99% with very few losses.

Transportation scenarios

Type	Module	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel (l/tkm)	Value (l/t)
Truck	A2	44	Lorry >32t EURO4*	144	0,022	3,2
Oceangoing ship	A2	N/A	Transoceanic ship	24682	0,0005	12,4
Waste collection	A3, C2	55	Lorry 21t	19	0,391	7,43
Truck	A3	33	Lorry 7,5-16t EURO5	52	0,055	2,86
Truck	A4	44	Lorry >32t EURO6	180	0,022	3,96
Truck	C2	26	Lorry 16-32t EURO5	278	0,044	12,23

* Chinese emission standards (China 1-6) are based on European standards. It is assumed that nationwide adoption of Euro 4-equivalent standards was reached in 2015.

End of life (C1-C4)

	Unit	Value
Hazardous waste disposed	kg	0
Colleced as mixed construction waste	kg	0
Reuse	kg	0
Recycling	kg	0,95
Energy recovery	kg	0
To landfill	kg	0,05

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Net new scrap	kg	0,52

Module D is calculated as net scrap * LCI for scrap, where the scrap LCI is calculated as the credit for avoided primary production of steel, minus the burden of recycling steel scrap to make new steel, multiplied by the process yield (>1kg scrap is needed to make 1kg new steel). Recycling rate and LCI for scrap has been provided by Worldsteel (Eurofer, 2019; Worldsteel, 2017).

LCA: Results

Key assumptions and estimates are either presented in the EPD or can be found in the PCRs listed for this study.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assemby stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	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	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Environmental impact

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
GWP	kg CO_2 -eqv	1,98E+00	1,49E-02	2,15E-02	6,86E-02	5,73E-04	2,65E-04	-8,33E-01	
ODP	kg CFC11-eqv	4,69E-08	3,07E-09	3,87E-09	1,23E-08	1,87E-10	8,84E-11	4,66E-09	
POCP	kg C_2H_4 -eqv	8,52E-04	2,29E-06	4,30E-06	1,14E-05	9,97E-08	9,70E-08	-3,62E-04	
AP	kg SO_2 -eqv	9,57E-03	3,79E-05	1,63E-04	2,47E-04	3,37E-06	1,97E-06	-1,65E-03	
EP	kg PO_4^{3-}-eqv	9,61E-04	5,27E-06	3,51E-05	4,63E-05	8,03E-07	3,40E-07	-1,81E-04	
ADPM	kg Sb-eqv	1,12E-06	3,04E-08	7,21E-09	1,54E-07	2,47E-09	3,05E-10	-2,63E-06	
ADPE	MJ	2,25E+01	2,45E-01	3,09E-01	9,89E-01	8,31E-03	7,57E-03	-1,21E+01	

GWP Global warming potential; **ODP** Depletion potential of the stratospheric ozone layer; **POCP** Formation potential of tropospheric photochemical oxidants; **AP** Acidification potential of land and water; **EP** Eutrophication potential; **ADPM** Abiotic depletion potential for non fossil resources; **ADPE** Abiotic depletion potential for fossil resources; **INA** Indicator not assessed

Resource use

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D	
RPEE	MJ	6,84E-01	3,07E-03	1,42E-03	7,96E-03	8,06E-03	5,04E-05	-5,38E-01	
RPEM	MJ	1,05E-02	8,34E-04	2,40E-04	2,28E-03	2,98E-04	8,97E-05	-2,64E-12	
TPE	MJ	6,95E-01	3,91E-03	1,66E-03	1,02E-02	8,36E-03	1,40E-04	-5,38E-01	
NRPE	MJ	2,25E+01	2,45E-01	3,09E-01	9,90E-01	8,31E-03	7,57E-02	-1,21E+01	
NRPM	MJ	2,33E-01	7,54E-03	2,60E-03	1,84E-02	2,10E-02	1,12E-04	-2,95E-01	
TRPE	MJ	2,27E+01	2,52E-01	3,12E-01	1,01E+00	2,93E-02	7,68E-03	-1,24E+01	
SM	kg	4,30E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
W	m^3	2,17E-02	4,42E-06	1,75E-06	1,11E-05	4,33E-06	1,26E-06	-6,10E-01	

RPEE Renewable primary energy resources used as energy carrier; **RPEM** Renewable primary energy resources used as raw materials; **TPE** Total use of renewable primary energy resources; **NRPE** Non renewable primary energy resources used as energy carrier; **NRPM** Non renewable primary energy resources used as materials; **TRPE** Total use of non renewable primary energy resources; **SM** Use of secondary materials; **RSF** Use of renewable secondary fuels; **NRSF** Use of non renewable secondary fuels; **W** Use of net fresh water; **INA** Indicator not assessed

End of life - Waste									
Parameter	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**	
HW	kg	2,51E-06	1,28E-07	1,39E-07	5,10E-07	2,51E-08	5,38E-09	-1,25E-17	
NHW	kg	0,46	0,02	3,40E-04	3,46E-02	6,67E-05	5,00E-02	2,13E-16	
RW	kg	2,75E-05	1,77E-06	2,17E-06	7,01E-06	3,19E-07	4,98E-08	0,00E+00	

Hazardous and radioactive waste is calculated from deposited goods from background processes. Non-hazardous waste are specific recorded waste from the manufacturer, and deposited goods.

HW Hazardous waste disposed; **NHW** Non hazardous waste disposed; **RW** Radioactive waste disposed; **INA** Indicator not assessed

End of life - Output flow									
Parameter	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**	
CR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
MR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,50E-01	0,00E+00	0,00E+00	
MER	kg	6,68E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
ETE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	

CR Components for reuse; **MR** Materials for recycling; **MER** Materials for energy recovery; **EEE** Exported electric energy; **ETE** Exported thermal energy; **INA** Indicator not assessed

Reading example: 9,0 E-03 = $9{,}0*10^{-3}$ = 0,009

The results show that the extraction and processing of raw materials for steelmaking in A1 is the most dominating process, accounting for approx. 81% of the Global Warming Potential. Transportation is in this EPD a significant driver for potential impacts, with 14% of the GWP emissions. This module also has the highest relative impacts of ODP, acidification and eutrophication as shown in Figure 2. Emissions in A2 can mainly be attributed to the burning of heavy fuel oil during transoceanic ship transportation.

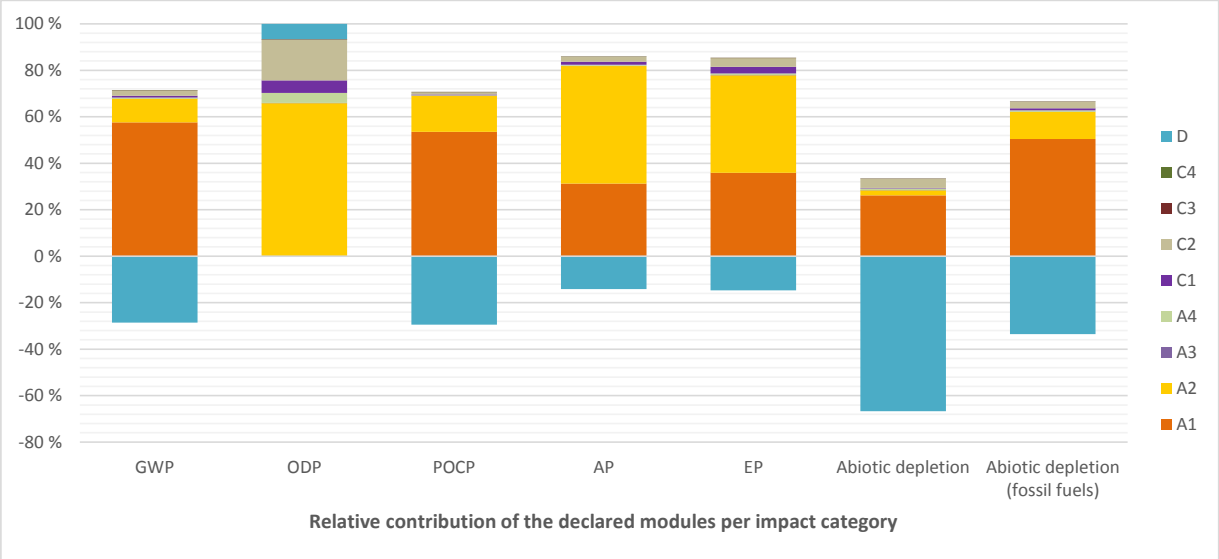

Figure 2: Relative contribution for the declared modules.

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase
The electricity mix used in the manufacturing stage (A3) is specific to Norwegian electricity production and imports, transformed to medium voltage (including the transmission network; direct emissions to air; electricity losses during transmission).
Reference year: 2014

Data source	Module	Amount	Unit
ecoinvent v 3.4	A3	0,0276 (NO)	kg CO_2-eqv/kWh

Dangerous substances

☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. [1]

☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.

☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.

☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

[1] No substances as given by REACH are used or have been added to the production.

Indoor environment
No tests have been carried out on the product concerning indoor climate - Not relevant

Carbon footprint
Carbon footprint has not been worked out for the product.

Bibliography

EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
Eurofer (2019)	*Personal communication, w/ Nicholas Avery, email, 21.02.2019.*
ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
ISO 14044:2006	*Environmental management - Life cycle assessment - Requirements and guidelines*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
Jenssen, M. M. (2019)	*Life Cycle Assessment Report:* *Steel sheet piles & welded steel tubes*
NPCR 013rev1 (2013)	*Product Category Rules Steel as Construction Material*
NPCR Part A (2017)	*Construction products and services*
Raadal et al. (2009)	*Klimaregnskap for avfallshåndtering. Fase I og II: Glassemballasje, metalemballasje, papir, papp, plastemballasje, våtorganisk avfall, treavfall og restavfall fra husholdninger. Avfall Norge–Rapport 5/2009*
Worldsteel (2017)	*World Steel Association Life Cycle Inventory Methodology Report, Brussels: World Steel Association*

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