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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:	Hydro Aluminium AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-2265-1034-EN
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Valid to:	18.06.2025

Hydro Aluminium Primary Foundry Alloys Europe Si content > 8%

Hydro Aluminium AS

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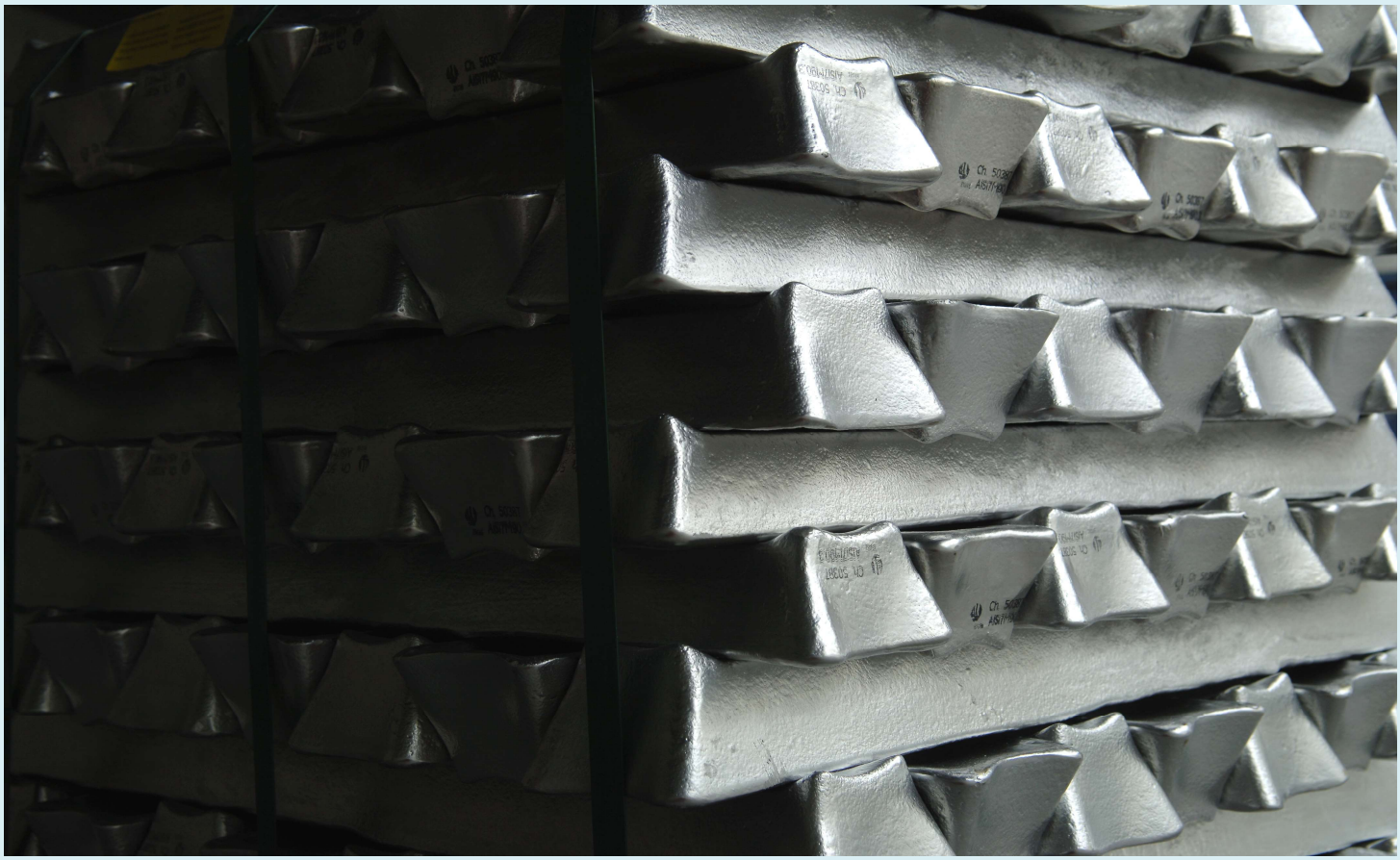

General information

Product:
Hydro Aluminium Primary Foundry Alloys Europe, Si content >8%

Owner of the declaration:
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Declaration number:
NEPD-2265-1034-EN

Place of production:
Hydro Aluminium Sunndal
Hydro Aluminium Årdal
Slovalco

ECO Platform reference number:

Management system:
IATF 16949, ISO 9001:2016, ISO 14001, ISO 45001, ISO 50001

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
NPCR 013, "Version 3.0 Part B for steel and aluminium construction products"

Organisation no:
917 537 534

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 manufacturerinformation, life cycle assessment data and evidences.

Issue date:
18.06.2020

Valid to:
18.06.2025

Declared unit:
1 kg Hydro Aluminium Primaru Foundry Alloy Europe, Si content >8%

Year of study:
2020

Declared unit with option:
1 kg Hydro Aluminium Primary Foundry Alloy Europe, Si content >8% , including waste handling and possible environmental benefits after end of life.

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

Functional unit:
The product is an input to automotive parts and to different building and construction products. No use scenarios are defined, hence no functional unit.

The EPD has been worked out by:
Irmeline de Sadeleer, Andreas Brekke, Kari-Anne Lyng

Irmeline de Sadeleer

Østfoldforskning

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:

Jane Anderson

Jane Anderson, ConstructionLCA Limited
(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
This EPD covers production of Primary Foundry Alloys from Hydro Aluminium's European Smelters with alloy content > 8% Consistent high metal quality is ensured by using top-grade raw materials, standardized production processes and continuous quality control.

Product specification:

Materials	kg	%
Primary Liquid Al from own Electrolysis	0.85-0.9	85-90%
Primary Metal from external sources	0.01-0.03	1-3%
Alloying Elements	0.08-0.12	8-12%

Examples of Industry we serve:
Automotive (Wheels, Chassis & Engine parts), Electrical applications, decorative / anodized applications

Market:
European Automotive & non automotive market for cast parts

Technical data:
All alloys meet specifications in accordance with relevant ISO, EN and JIS standards.
Alloys are produced as continuous cast or mold cast ingots. The products are stacked and strapped into bundles of various sizes. Depending on the particular production source, our foundry alloy ingots are supplied in weights of 7-22 kg, and bundle weights can range from 700-1200 kg.

For more detailed information on our products:
https://www.hydro.com/en-NO/products-and-services/casthouse-products/foundry-alloys/

Reference service life, product:
Dependent on product application, but the material itself has an infinite life time.

Reference service life, building:
Dependent on product application, but the material itself has an infinite life time.

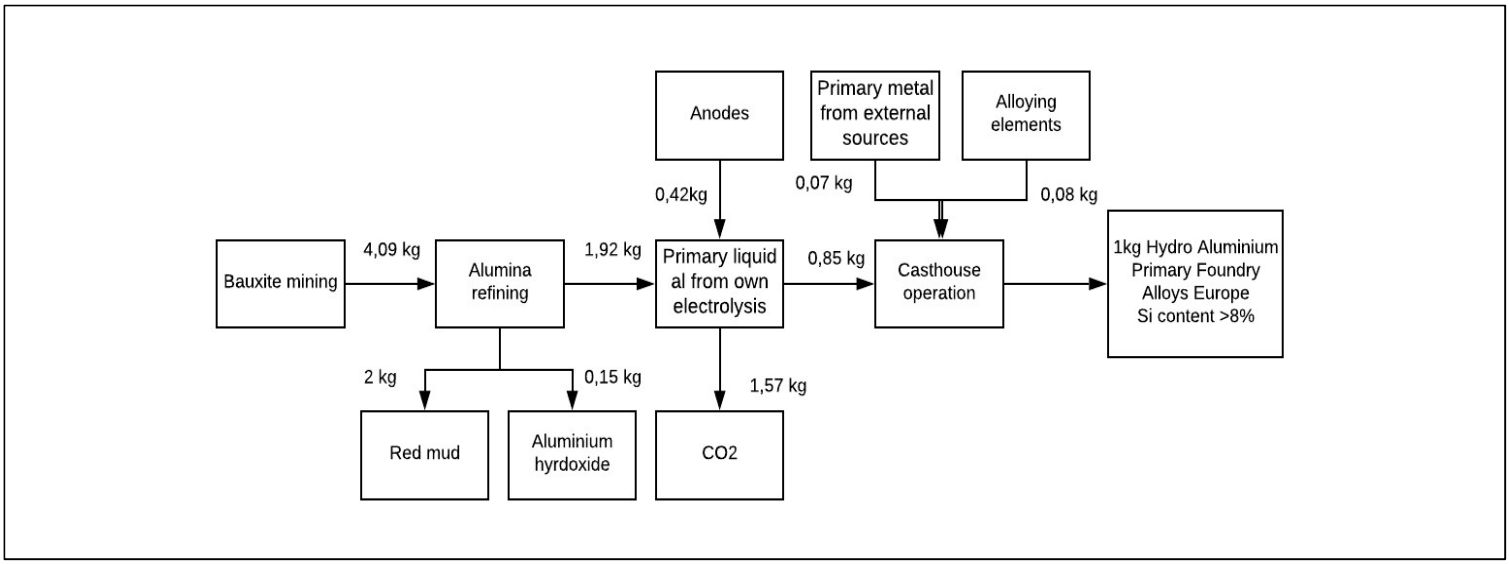
LCA: Calculation rules

Declared unit:
1 kg Hydro Aluminium Primary Foundry Alloys Europe Si content >8%. The EPD also covers modules C2-C4 and D.

The foundry alloys are produced in three smelters: Sunndal and Årdal in Norway, and Slovalco in Slovakia. The presented results is a weighed average of production volumes in 2017.

System boundary:
Cradle to gate with options. The following stages have been declared: A1-A4, C2-C4 and D. Further specified in flow sheet below.

Module D covers the potential benefits from recycling of Hydro Aluminium Foundry Alloy after end of useful life. Module D covers all necessary stages from C3 until the aluminium is back on the market and compares to the environmental performance of an average market foundry alloy. The module is further specified under scenarios.



Data quality:
Specific data are used for all of Hydro's processes, based on the production year 2017, and are collected the first months of 2019. As Hydro has ownership in a total value chain from mining of bauxite to production of aluminium extrusion ingots, all stages from A1 to A4 are covered by specific data. Background data on for instance transport and electricity production are from ecoinvent 3.4 (April 2018).

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, and mostly apply for alloying elements that are added in less than per thousandth.

Allocation:
The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production inhouse is allocated equally among all products through mass allocation. For almost all processes, detailed data are provided for each process step, and the main allocation is between aluminium hydroxide and aluminium oxide in the production of alumina. Effects of primary production of recycled materials are allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

The transport from production sites to market is assumed to be the weighted distance from the two smelters in Norway and the one in Slovakia to a location in central Europe.

Transport from production place to user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption
Truck	50	Lorry, >32 metric tons, Euro V	611	2.46 E-02 l/tkm
Boat	80	Cargo ship, 5000 tons	1019	1.56 E-02 l/tkm

Most of the aluminium used for construction purposes is collected (approximately 96%) and recycled (approximately 97% of the collected aluminium), giving a total of 93% recycled. The aluminium is transported to a material processing site where different materials, including metals are shredded and sorted. Most of the aluminium used in the automotive industry is collected (approximately 95%) and recycled (approximately 97% of the collected aluminium), giving a total of 92% recycled. The rest is assumed landfilled.

End of Life (C2, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	-
Collected	kg	0.951
Reuse	kg	-
Recycling	kg	0.924
Energy recovery	kg	0.027*
To landfill	kg	0.049**

* 27 grams of the original 1 kg of aluminium is going to incineration. No loads or beneifts are attribuded to this flow.

**There will be a small portion of aluminium ending as uncollected. This is included under "To landfill" where no loads or benefits are included.

Transport to waste processing (C2)

Type	Capacity utilisation	Type of vehicle	Distance km	Fuel/Energy
Truck	40	Lorry, >32 metric tons, Euro V	50	2.85 E-02 l/tkm

Aluminium from construction site to waste handling site is assumed to be transported in an older medium-sized lorry with smaller capacity utilization than in the production system

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Aluminium foundry alloy to recycling	g	924

Aluminium collected and recycled is assumed to replace an average extrusion ingot in Europe consisting of 40% recycled and 60% primary aluminium. This is a conservative approach.

LCA: Results

All results are calculated with the use of SimaPro v.9 (2019) and impact methods according to ISO 15804. Results are based on a weighted average between three production sites.

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	MND	x	x	x	x

Environmental impact

Parameter	Unit	A1-A3	A4	C2	C3	C4		D	
GWP	kg CO_2-eqv	4.95E+00	6.99E-02	7.78E-03	2.48E-01	0.00E+00		-4.87E+00	
ODP	kg CFC11-eqv	4.21E-07	1.92E-08	1.44E-09	9.63E-09	0.00E+00		-2.98E-07	
POCP	kg C_2H_4-eqv	1.33E-03	1.97E-05	1.29E-06	3.04E-05	0.00E+00		-2.61E-03	
AP	kg SO_2-eqv	2.75E-02	4.72E-04	3.05E-05	6.97E-04	0.00E+00		-3.10E-02	
EP	kg PO_4^{3-}-eqv	8.73E-03	7.15E-05	5.47E-06	1.59E-04	0.00E+00		-1.62E-03	
ADPM	kg Sb-eqv	9.95E-06	1.07E-07	2.35E-08	1.64E-06	0.00E+00		-1.22E-05	
ADPE	MJ	4.56E+01	1.63E+00	1.25E-01	1.35E+00	0.00E+00		-4.71E+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

Resource use

Parameter	Unit	A1-A3	A4	C2	C3	C4		D	
RPEE	MJ	5.11E+01	1.25E-02	1.19E-03	1.72E-01	0.00E+00		-2.29E+01	
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
TPE	MJ	5.11E+01	1.25E-02	1.19E-03	1.72E-01	0.00E+00		-2.29E+01	
NRPE	MJ	5.38E+01	1.57E+00	1.20E-01	1.52E+00	0.00E+00		-5.72E+01	
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
TRPE	MJ	5.38E+01	1.57E+00	1.20E-01	1.52E+00	0.00E+00		-5.72E+01	
SM	kg	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	
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	
W	m^3	6.08E-02	2.69E-04	2.25E-05	7.37E-04	0.00E+00		-4.36E-02	

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

End of life - Waste

Parameter	Unit	A1-A3	A4	C2	C3	C4		D	
HW	kg	2.05E-02	7.34E-07	7.61E-08	6.11E-03	0.00E+00		4.91E-03	
NHW	kg	3.36E+00	8.13E-02	6.36E-03	1.15E+00	9.80E-02		-2.49E+00	
RW	kg	2.71E-04	1.08E-05	8.12E-07	4.81E-06	0.00E+00		-2.26E-04	

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life - Output flow

Parameter	Unit	A1-A3	A4	C2	C3	C4		D	
CR	kg	-	-	-	-	-		-	
MR	kg	-	-	-	9.25E-01	-		-	
MER	kg	-	-	-	2.57E-02	-		-	
EEE	MJ	-	-	-	-	-		-	
ETE	MJ	-	-	-	-	-		-	

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9.0 E-03 = $9.0*10^{-3}$ = 0.009

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase
National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

Data source	Amount	Unit
ecoinvent v3.4 (April 2018)	4	g CO_2-eqv/kWh

Dangerous substances

- ☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- ☐ 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 than 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.

Name	CAS no.	Amount

Indoor environment
Not relevant

Carbon footprint

Calculations connected to climate change and global warming potential (GWP) include greenhouse gas emissions from fossil sources and land use change connected to extraction of bauxite, but does not include calculations of biogenic emissions of CO_2.

Bibliography

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*
EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
NPCR 013	*NPCR 013 version 3.0 Part B for steel and aluminium construction products.*
Sadeleer, I., Brekke, A. and Lyng, Kari-Anne (2020)	*Background report for the Environmental Product Declarations for Hydro Aluminium Wire Rod, Hydro Aluminium Sheet Ingot and Hydro Aluminium Foundry Alloy*

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