Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

Carbon steel reinforcement bars

from

NLMK-Kaluga LLC
Bld. 1, est. 6, Lyskina street, Vorsino village, Borovsky district, Kaluga region, 249020
Russian Federation

Programme:	The International EPD® System, www.environdec.com
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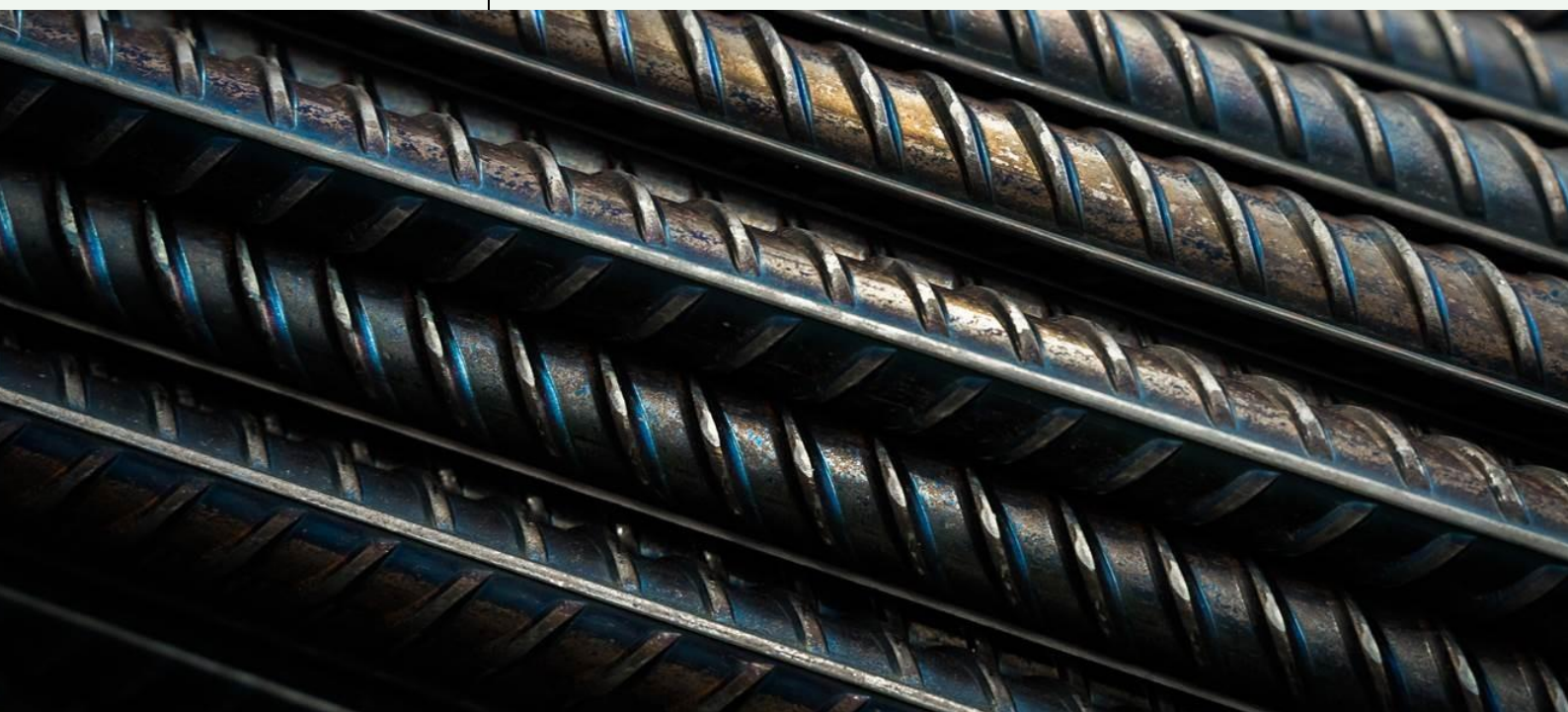

Company information

Owner of the EPD:

NLMK-Kaluga LLC
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Description of the organisation:

NLMK-Kaluga LLC is a balanced steel-making complex with full production cycle from steelmaking to finished product shipment.
NLMK-Kaluga LLC is a steel-making enterprise belonging to NLMK Group's Long Products Division and managed by NLMK-Long Products. The NLMK-Kaluga LLC construction project proved to be an important milestone in the development of NLMK-Long Division located in the Kaluga Region. Production capacity: 1.5 Mt/y of liquid steel and 0.9 Mt/y of long products and sections. This construction project was completed by NLMK Group in 2013 and was also included into the list of priority investment projects of Russian Steelmaking Industry Development Strategy 2020.
The new entity of NLMK-Long Products Division provides the central regions of Russia and the EU with high-quality construction steel products. Well established technologies and equipment are in consonance with world ironmaking trends. Hence, production parameters ensure high level of energy and resource savings, high quality output and environmental safety.

Product-related or management system-related certifications:

NLMK Kaluga is certified to the following management system standards.:

- ENVIRONMENTAL MANAGEMENT SYSTEM – ISO 14001:2015 (EMS 598729, Expiry Date 2022-05-22, BSI, UK)
- QUALITY MANAGEMENT SYSTEM – ISO 9001:2015 (FM 598728, Expiry Date 2022-05-22, BSI, UK)
- ENERGY MANAGEMENT SYSTEM – ISO 50001:2011 (ENMS 598731, Expiry Date 2020-05-25, BSI, UK

Name and location of production site:

NLMK-Kaluga LLC
Bld. 1, est. 6, Lyskina street, Vorsino village, Borovsky district, Kaluga region, 249020
Russian Federation

Product information

Product name:
Carbon steel reinforcement bars

Product identification:
Marking in the form of thickened transverse ribs, mark 9/47

Product description:
Steel rebar (according to the standards for the products of Denmark, Sweden, Norway, Finland), obtained from scrap, melted in chipboard followed by hot rolling. Designed for reinforcement of reinforced concrete structures of buildings and structures. The composition of steel reinforcement products does not change during use.

UN CPC code:
41242, 41244

Geographical scope:
Nordic countries

LCA information

Functional unit / declared unit:
The declared unit is 1 kg of carbon steel rebar in bars. The system boundary of the EPD follows the modular structure defined in the standard EN 15804. It is a production cycle (from cradle to gate with options), which includes modules A1-A5, C1-C4 and module D.
Impacts and aspects related to production losses/waste (i.e. production, transportation and recycling of waste, and the end-of-life stage of production waste and materials loss) are addressed in the modules in which production losses/waste occur.

Reference service life:
not applicable

Time representativeness:
LCA calculation based on data collected from 1st January 2018 to 31st December 2018.

Database(s) and LCA software used:
The manufacturing process was modelled based on manufacturer-specific data. However, generic background datasets were used for the upstream and downstream processes.

For the LCA modelling the software GaBi, version 9.2, Service Pack 39, distributed by thinkstep was used. The background datasets used were taken from the current versions of various GaBi databases. The datasets contained in the databases are documented online. All necessary processes within the defined system boundaries were considered.

The background datasets used for accounting purposes should not be older than 10 years. In this study, no datasets older than 10 years were used.

Since only few Russian datasets are available, European datasets were used for processes in module A1-3. For distribution transports (A4), disposal of packaging materials (A5) and disposal scenarios (C modules), the corresponding European or global datasets were used. If no European datasets were available, German datasets were used.

Manufacturing process

The production takes place in following steps:

1) Scrap and raw materials are being delivered by truck or railway
2) Steel production in an electric arc furnace (EAF)
3) Steel refining in a ladle furnace
4) Steel casting in continuous casting machine
5) Heating of billets in the reheating furnace
6) Rolling of billets at a continuous rolling mill
7) Packaging
8) Shipment

System diagram:

Description of system boundaries:

System boundary: Cradle to gate (with options)

X = declared modules; MND = module not declared; NR = not relevant:

Production			Installation		Utilization Stage							Disposal Stage				beyond system boundary
raw material supply	transport to the manufacturer	manufacture	transport to the construction site	installation in the building	use / application	maintenance	repair	replacement	renewal	energy input for operation	water use for operation	dismantling / demolition	transport	waste management	landfilling	reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Content declaration

Product

MATERIALS / CHEMICAL SUBSTANCES	%	ENVIRONMENTAL / HAZARDOUS PROPERTIES
Chemical substance, C	0.25	no
Chemical substance, Mn	1.00	no
Chemical substance, Si	0.20	no
Chemical substance, P	0.050	no
Chemical substance, S	0.050	no
Chemical substance, Cr	0.30	no
Chemical substance, Ni	0.30	no
Chemical substance, Cu	0.50	no
Chemical substance, N	0.012	no
Chemical substance, Mo	0.08	no
Chemical substance, V	0.01	no
Chemical substance, B	0.0020	no
Chemical substance, As	0.08	no
Chemical substance, Pb	0.03	no
Chemical substance, Ti	0.025	no
Chemical substance, Al	0.005	no
Chemical substance, Fe	97	no
traces of residual elements		no

Packaging

Distribution packaging:
The steel rebars are being secured with 6.5 mm diameter steel wire rod.

Recycled material
The content of post-consumer steel scrap is 98.5%.

Cut-off criteria

Overall, the packaging materials (wire rod) have a mass share of 0.08%. Due to the low mass share compared to steel, no modelling was carried out. It can also be strongly assumed that the environmental impact of packaging materials will not exceed 1% each or 5% in total.

Data quality

The material and energy data collected are from the year 2018 including the raw materials and the energy consumption data for a production quantity of 137,022 tons and converted to 1 kg steel rebar product. The collected data were checked for plausibility and consistency. Good data quality can be assumed.

Background Data

The manufacturing process was modelled based on manufacturer-specific data. However, generic background datasets were used for the upstream and downstream processes. The background datasets used were taken from the current versions of various GaBi databases.

The datasets contained in the databases are documented online. All necessary processes within the defined system boundaries were considered.

The background datasets used for accounting purposes should not be older than 10 years. In this study, no datasets older than 10 years were used.

Since only few Russian datasets are available, available European datasets were used for processes in module A1-3. For distribution transports (A4), disposal of packaging materials (A5) and disposal scenarios (C modules), the corresponding European/global datasets were used. Where no such datasets were available, German datasets were used.

Estimates and Assumptions

- The collection rate for waste is 95%.
- The electricity mix in Kaluga region has a GWP of 0.422 kg CO2-eq/kWh. This was modelled using a combination of Russian electricity mix (0.614 kg CO2 eq/kWh) and nuclear energy (0.0047 kg CO2 eq/kWh). To achieve an average value of 0.422 kg CO2-eq/kWh, the share of nuclear energy was adjusted accordingly. The ratio of electricity mix to nuclear energy is thus 68.4 to 31.6.

Allocations

No allocations were made for the modelling of production processes, as the available data do not concern other products manufactured in the plant and there are no coupling processes. Nor were any multi-input processes carried out.
Allocations in the LCA datasets used are documented accordingly in the datasets themselves.
Potential credits and avoided burdens resulting from the scrap recycling in the *end of life* (Module C3) are assigned to module D.

LCA Scenarios and additional technical information

Transport from production place to user (module A4)

The average transport distance to the customer is 697 km by truck and 191 km by train. Transport is mainly carried out by diesel-powered trucks, EURO 4 with an average load factor of 61%, their carriers take cargos back to Lithuania from other clients. A capacity utilisation of 40% is assumed for railway transports.

Type	Capacity utilization	Type of vehicle	Average distance
Truck	61 %	EURO 4	697 km
Train	40 %	Cargo train	191 km

Dismantling/demolition (module C1)

60% of the reinforced concrete is demolished with cable excavator and wrecking ball (diesel consumption of excavator: 60.8 litres/hour; capacity approx. 15 m³/h) and 40% is dismantled with hydraulic excavator and tongs (diesel consumption of excavator: 36.1 litres/hour; capacity approx. 20 m³/h). The ratio of reinforcing steel to concrete content is 4.8 %, corresponding to 120 kg reinforcing steel per m³ reinforced concrete (Source: German Environment Agency). Calculated diesel consumption for the demolition of 1 kg reinforcement steel is 0.0013 litres.

Type	Share	Reinforced concrete/hour	Diesel/ hour	Steel in reinforced concrete
Cable exacavator and wrecking ball	60 %	15 m^3	60.8 l	4.8 % = 120 kg
Hydraulic excavator and tongs	40 %	20 m^3	36.1 l	4.8 % = 120 kg

Transport (module C2)

With a collection rate of 100%, the transports are carried out by truck over 75 km and with a capacity utilization of 50%.
Since the product is poured into concrete, it is collected as mixed construction waste.

Type	Capacity utilization	Type of vehicle	Average distance
Truck	50 %	EURO 4	75 km

Waste processing (modules C3 and C4)

Steel rebars must be mechanically separated from the concrete surrounding them prior to recycling so that the steel can be made available to a downstream product system as secondary material. This is considered in module C3. Corresponding potentials and avoided loads are assigned to module D. The landfilling of remaining 5 % which are not collected for recycling is considered in module C4.

Waste	kg for re-use	kg for recycling	kg for energy recovery	kg to landfill
Steel scrap	-	0.95	-	0.05

Recyclability potentials (module D)

Module D contains credits from the recycling of rebars in module C3.

Environmental performance

Potential environmental impact

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Environmental Impacts									
Global Warming Potential total (GWP)	kg CO2-eq.	4.57E-01	4.71E-02	0.00E+00	3.81E-03	7.01E-03	2.52E-03	4.05E-03	-2.41E-02
Global Warming Potential fossil (GWP-fossil)	kg CO2-eq.	4.57E-01	4.67E-02	0.00E+00	3.95E-03	6.94E-03	2.50E-03	4.05E-03	-2.40E-02
Global Warming Potential biogenic (GWP-biogenic)	kg CO2-eq.	1.51E-02	4.79E-03	0.00E+00	2.44E-04	7.60E-04	3.22E-04	1.18E-04	6.40E-04
Global Warming Potential luluc (GWP-luluc)	kg CO2-eq.	1.04E-04	6.66E-04	0.00E+00	5.78E-05	1.07E-04	3.16E-05	0.00E+00	6.87E-07
Stratospheric ozone depletion potential (ODP)	kg CFC-11-eq.	4.08E-13	4.63E-15	0.00E+00	4.59E-19	8.48E-19	5.98E-18	3.26E-13	5.25E-17
Acidification potential of soil and water (AP)	mol H+-eq.	2.67E-03	2.85E-04	0.00E+00	1.92E-05	4.25E-05	2.47E-05	5.38E-06	-5.36E-05
Eutrophication potential freshwater (EP-freshwater)	kg PO4-eq.	1.90E-07	2.10E-07	0.00E+00	1.82E-08	3.37E-08	1.08E-08	1.64E-08	-1.36E-08
Eutrophication potential marine (EP-marine)	kg N-eq.	4.17E-04	1.30E-04	0.00E+00	8.88E-06	2.05E-05	1.18E-05	1.53E-06	-9.78E-06
Eutrophication potential terrestrial (EP-terrestrial)	mol N-eq.	4.53E-03	1.43E-03	0.00E+00	9.81E-05	2.27E-04	1.30E-04	1.65E-05	-9.90E-05
Formation potential of tropospheric ozone (POCP)	kg C2H4-eq.	1.25E-03	2.57E-04	0.00E+00	2.49E-05	3.95E-05	3.45E-05	5.61E-06	-4.03E-05
Potential for abiotic depletion of non-fossil resources (ADPE)	kg Sb-eq.	1.12E-07	3.33E-09	0.00E+00	2.63E-10	4.86E-10	2.71E-09	2.81E-11	-3.91E-07
Potential for abiotic depletion of fossil fuels (ADPF)	MJ	7.46E+00	6.36E-01	0.00E+00	5.04E-02	9.30E-02	4.86E-02	9.77E-03	-2.07E-01
Water scarcity (WDP)	m³ world eq. Deprived	3.43E-02	1.21E-03	0.00E+00	8.15E-05	1.51E-04	4.98E-04	-7.90E-04	-1.81E-03

Use of resources

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Use of Resources									
Renewable primary energy as an energy carrier (PERE)	MJ	4.70E-01	3.75E-02	0.00E+00	2.92E-03	5.40E-03	3.46E-03	7.25E-04	1.60E-02
Renewable primary energy for material use (PERM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total renewable primary energy (PERT)	MJ	4.70E-01	3.75E-02	0.00E+00	2.92E-03	5.40E-03	3.46E-03	7.25E-04	1.60E-02
Non-renewable primary energy as an energy carrier (PENRE)	MJ	7.47E+00	6.37E-01	0.00E+00	5.04E-02	9.31E-02	4.86E-02	9.77E-03	-2.07E-01
Non-renewable primary energy for material use (PENRM)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total non-renewable primary energy (PENRT)	MJ	7.47E+00	6.37E-01	0.00E+00	5.04E-02	9.31E-02	4.86E-02	9.77E-03	-2.07E-01
Use of secondary materials (SM)	kg	1.12E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of freshwater resources (FW)	m^3	1.33E-03	6.33E-05	0.00E+00	4.94E-06	9.13E-06	1.45E-05	-1.84E-05	-4.25E-05

Waste production

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Waste Categories									
Hazardous waste to landfill (HWD)	kg	4.21E-09	3.25E-08	0.00E+00	2.82E-09	5.20E-09	1.52E-09	0.00E+00	-2.65E-08
Non-hazardous waste disposed (NHWD)	kg	1.91E-03	5.59E-05	0.00E+00	4.10E-06	7.57E-06	9.85E-06	4.95E-02	2.47E-03
Disposed radioactive waste (RWD)	kg	9.22E-04	4.45E-06	0.00E+00	6.84E-08	1.26E-07	7.17E-07	1.73E-07	7.36E-09

Output flows

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Output Categories									
Components for Reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	1.95E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-01	0.00E+00	0.00E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electric energy (EEE)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (EET)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Other environmental indicators

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Additional Impact Categories and Indicators									
GWP-GHG[1]	kg CO2-eq.	4.50E-01	4.62E-02	0.00E+00	3.90E-03	6.87E-03	2.46E-03	3.45E-03	-2.32E-02
Potential incidence of disease due to PM emissions (PM)	Incidence of disease	3.00E-08	1.29E-09	0.00E+00	2.14E-10	1.52E-10	5.44E-10	6.87E-11	-8.06E-10
Potential Human exposure efficiency relative to U235 (IR)	kBq U235-eq.	7.48E-02	3.53E-04	0.00E+00	1.00E-05	1.85E-05	1.14E-04	1.70E-04	4.46E-04
Eco-toxicity, freshwater (ETP-fw)	CTUe	1.84E+00	4.00E-01	0.00E+00	3.39E-02	6.27E-02	3.14E-02	1.82E-02	-1.22E-03
Human toxicity, cancer effects (HTP-c)	CTUh	1.60E-10	8.44E-12	0.00E+00	6.80E-13	1.26E-12	7.13E-13	6.43E-13	7.38E-12
Human toxicity, non-cancer effects (HTP-nc)	CTUh	2.75E-09	3.59E-10	0.00E+00	3.35E-11	5.56E-11	3.21E-11	8.43E-11	-2.49E-10
Potential soil quality index (SQP)	dimension-less	6.97E-01	2.62E-01	0.00E+00	2.27E-02	4.20E-02	1.37E-02	6.41E-04	5.58E-03

[1] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

General information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com Info@environdec.com
PCR:	Construction products (EN 15804:A2); Version 1.0; 2019-12-20; https://www.environdec.com/PCR/Detail/?Pcr=%2014759
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☑ EPD verification
Third party verifier:	Andreas Ciroth, GreenDelta GmbH
Accredited and approved by:	The International EPD System
Differences versus previous version:	Update of “Recycled material” (p.6), indicator “use of secondary material (SM)” in module A1-A3 and indicators in Module D. Inclusion of GWP-GHG indicator.
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The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

References

The International EPD System	General Programme Instructions of the International EPD® System. Version 3.01.
The International EPD System	PCR Construction products (EN 15804:A2); Version 1.0; 2019-12-20; https://www.environdec.com/PCR/Detail/?Pcr=%2014759
DIN EN ISO 14025	Environmental labels and declarations — Type III environmental declarations — Principles and procedures; 2009-11.
DIN EN ISO 14044	Environmental management - Life cycle assessment - Requirements and guidance (ISO 14044:2006); German and English version EN ISO 14044:2006.
DIN EN 15804	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products; German version EN 15804:2012+A2:2019
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UN CPC	United Nations Department of Economic and Social Affairs Statistics Division: Central Product Classification (CPC), Version 2.1

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