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Environmental Product Declaration

Portland Cement Clinker

Manufactured by **Nuh Çimento Sanayi A.Ş.** in accordance with
ISO 14025 and EN 15804:2012+A2:2019/AC:2021

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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.

ISO standard ISO 21930 and CEN standard EN 15804 serves as the core Product Category Rules (PCR)

Product Category Rules (PCR):

PCR 2019:14 Construction products, version 1.2.5, Construction EN 15804:2012+A2:2019/AC:2021 Sustainability of Construction Works

PCR review was conducted by: The Technical Committee of the International EPD® System. Review chair: Claudia A. Peña, University of Concepción, Chile

EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison.

Third-party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:

EPD verification by individual verifier

Third party verifier: Prof. Ing. Vladimír Kočí, Ph.D.,
Šárecká 5, 16000 Prague 6 - Czech Republic

Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

Yes No

Nuh Çimento Sanayi A.Ş. has the sole ownership, liability, and responsibility for this EPD.

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How to Read This EPD?

An Environmental Product Declaration (EPD) is an ISO Type III Environmental Declaration based on ISO 14025 standard. An EPD transparently reports the environmental performance of products or services from a lifecycle perspective. The preparation of an EPD includes different stages, from acquiring raw materials to the end of life of the final product/service. EPDs are based on international standards and consider the entire value chain. Additionally, EPD is a third-party verified document. This EPD includes several sections described below.

1. General and Program Information

The first part of an EPD has information about the name of the manufacturer and product/service and other general information such as the validity and expiration dates of the document, the name of the program operator, geographical scope, etc. The second page states the standards followed and gives information about the program operator, third-party verifier, etc. The followed Product Category Rule (PCR) is indicated on the second page.

2. Company and Product/Service Information

Information about the company and the investigated product is given in this section. It summarizes the characteristics of the product provided by the manufacturer. It also includes information about the product such as product composition and packaging.

3. LCA Information

LCA information is one of the most important parts of the EPD as it describes the functional/declared unit, time representativeness of the study, database(s) and LCA software, along with system boundaries.

The table presented in this part has columns for each stage in the life cycle. The considered stages are marked 'X' whereas the ones that are not considered are labeled as 'NR'. Not all EPDs consider the full life cycle assessment for a product's entire life stages. The 'System Boundary' page is also the place where one can find detailed information about the stages and the assumptions made.

4. LCA Results

The results of the Life Cycle Assessment analysis are presented in table format. The first column in each table indicates the name of the impact category and their measurement units are presented in the second column. These tables show an amount at each life cycle stage to see the impact of different indicators on different stages. Each impact can be understood as what is released through the production of the declared unit of the material—in this case, 1 tonnes portland cement clinker production. The benefits of reuse/recycling of the declared product is reflected in this section.

The first impact in the table is global warming potential (GWP), which shows how much CO₂ is released at each stage. Other impacts include eutrophication potential, acidification potential, ozone layer depletion, land use related impacts, etc. The second table provides results for resource use and the third table is about the waste produced during the production. The fourth and final table shows the results for the GWP-GHG indicator, which is almost equivalent to the GWP-Total indicator mentioned previously. The only difference is that this indicator excludes the biogenic carbon content by following a certain methodology.

About Nuh Çimento

Nuh Cement Group, by contributing to production, employment, and economy of its country since 1966, offers high quality products and services such as clinker, cement, ready mix concrete, lime, aerated concrete, and aluminum paste to the construction industry.

Clinker production started in 1969 with a capacity of 400.000 tons and today, Nuh Cement is the cement factory with the highest clinker production capacity under a single roof in Türkiye and Europe, with a capacity of 4,6 million tons per year, and cement production capacity of 5,7 million tons/year. It carries out its export and import activities at its own private port facilities with an LOA of 595 meters on a 57.000 m2 area. It serves ships up to 80.000 Dw tons.

Nuh Cement exports around 4,5 million tons of cement on an annual basis, covering 50% of the total cement export from Türkiye to United States, and 24,2% of total cement exports from Türkiye by sea. Nuh Cement sells 80% of its production to international markets and 20% to the domestic market. Nuh Cement Group exports its products to more than 50 countries.

In addition to cement production, the company is also the founder and partner of firms that produce other construction materials. Among these are Nuh Concrete, one of Türkiye's leading ready-mix companies operating in the Marmara region, Nuh Construction Materials company with product portfolio of wall blocks, lime, alpha gypsum and aluminum paste, Nuh Real Estate, manages various construction, investment, and real estate development activities, and Cim-Nak, provides services of extraction and transportation of mines that are used in cement production. Nuh Group gives back to the community via its foundation which builds and donates hospitals and schools to the state, also provides scholarships to university students.



About The Product

The investigated product is company's ordinary portland clinker suitable for producing ordinary portland cement and blended cement according to EN 197-1:2011. During the production, high temperatures are needed to heat a uniform blend of raw materials in a rotary kiln.

The manufacturer produces 5 types of clinker. These are ordinary clinker, low-alkaline clinker, low-chrome clinker, oil-well clinker and sulphate resistant clinker. Environmental performances between these clinker do not differ more than 10%.



Material	Weight percentage (%)
Marl	47.0
Limestone	47.0
Bauxite	2.0
Others (fayalite, tile waste etc.)	4.0
Cementitious materials	1.0

This EPD is an average EPD representing these 5 types of clinker. Life cycle assessment results are provided for ordinary portland cement which constitutes more than 99% of clinker production volume of the manufacturer. Table above provides main material inputs for the investigated product. In addition to these materials, fuels such as hard coal, petroleum coke, natural gas, liquids and refuse-derived fuels are used in the production.

Produced clinker are sold only in bulks thus it does not require any packaging material input.

Technical specifications of the portland cement clinker are provided in the table below.

Chemical Properties	Nuh Çimento	Standard	Unit
SiO ₂	21,15	-	%
Al ₂ O ₃	4,98	-	%
Fe ₂ O ₃	4,05	-	%
CaO	66,23	-	%
MgO	1,55	max. 5,0	%
SO ₃	0,43	-	%
Loss on Ignition	0,22	-	%
Cl-	0,0138	-	%
Alkali equivalent Na ₂ O + 0.658 K ₂ O	0,45	-	%
Free Lime	1,47	-	%
CaO / SiO ₂	3,13	min. 2,0	%
C ₃ S	62,37		
C ₂ S	13,61		
C ₃ A	6,35		

System Boundary

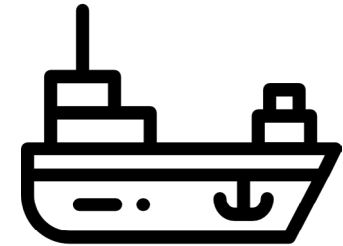
A1 - Raw Material Supply

This stage includes raw materials extraction and pre-treatment processes before production. Main materials used in the production of clinker is clay, limestone, bauxite, marl, and some cementitious materials. In addition, pre-use impacts of fuels, such as petroleum coke, hard coal, natural gas, liquid waste are included at this stage.



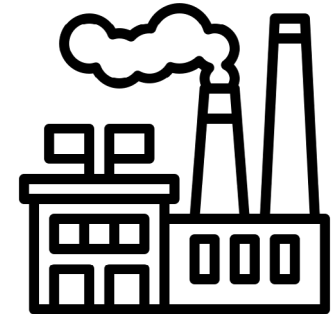
A2 - Raw Material Transport

This stage includes transportation related impacts of needed materials for the production of clinker. It is observed that both highway and seaway transportation are heavily involved at this stage. Transport routes and distances are supplier-specific and provided by the manufacturer.



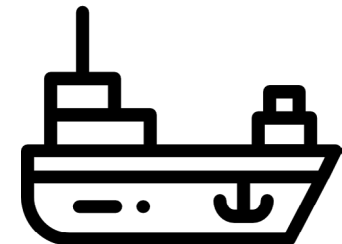
A3 - Manufacturing

This stage includes production-related environmental impacts of the investigated product. Main steps of clinker production are raw material crushing, pre-homogenization, fine grinding and clinker production at kiln. All energy-related inputs are supplied by the manufacturer. Since product is sold only in bulks, no packaging material is considered.



A4 - Final product shipment

This stage is relevant for the delivery of final product (clinker) to the intended markets and customers. Highway and seaway transportation are involved in this stage. The transport routes and distances are supplier-specific and provided by the manufacturer.



LCA Information

Declared Unit

1000 kg of portland cement clinker.

System Boundary

Cradle to gate with optional module (A4).

Cut-Off Rules

1% cut-off is applied. Data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts have been included.

REACH Regulation

No substances included in the Candidate List of Substances of Very High Concern for authorization under the REACH regulations are present in this product either above the threshold for registration with the European Chemicals Agency or above 0.1% (wt/wt).

Background Data

For LCA modelling and calculation, ecoinvent database (v3.9.1) and SimaPro (v9.5) LCA software were used.

LCA Modelling, Calculation and Data Quality

The results of the LCA with the indicators as per EPD requirements are given in the LCA result tables. All energy calculations were obtained using Cumulative Energy Demand (LHV) methodology, while freshwater use is calculated with selected inventory flows in SimaPro according to the PCR. There are no co-product allocations within the LCA study underlying this EPD. The regional energy datasets were used for all energy calculations.

Biogenic Carbon Content

The product does not contain biogenic carbon and it is sold only in bulks thus, there is no biogenic carbon content due to packaging.

Period Under Review

The data used for LCA study concerns the year 2022.

Allocations

Energy consumptions were weighted according to 2022 production figures. In addition, hazardous and non-hazardous waste amounts were also allocated from the total waste generation in 2022.

LCA Information

	Product Stage			Construction Process Stage		Use Stage							End of Life Stage			Benefits and Loads	
	Raw Material Supply	Transport	Manufacturing	Transport	Construction Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction / Demolition	Transport	Waste Processing	Disposal	Future reuse, recycling or energy recovery potentials
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules Declared	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	GLO	GLO	TR	GLO	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific Data Used	>90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation - Products	<10%					-	-	-	-	-	-	-	-	-	-	-	-
Variation - Sites	0%					-	-	-	-	-	-	-	-	-	-	-	-

(X = Module included, ND = Not declared)

LCA Results



Core environmental impact indicators (Mandatory)	Unit	A1-A3	A4
GWP - Fossil	kg CO ₂ eq.	9.98E+02	3.88E+01
GWP - Biogenic	kg CO ₂ eq.	1.49E+01	-5.25E-03
GWP - Luluc	kg CO ₂ eq.	5.08E-01	3.46E-02
GWP - Total	kg CO ₂ eq.	1.01E+03	3.88E+01
ODP	kg CFC-11 eq.	3.53E-06	6.25E-07
AP	mol H+ eq.	2.61E+00	9.10E-01
EP - Freshwater	kg P eq.	1.86E-01	1.71E-03
EP - Marine	kg N eq.	7.42E-01	2.09E-01
EP - Terrestrial	mol N eq.	8.14E+00	2.32E+00
POCP	kg NMVOC	2.25E+00	6.52E-01
*ADPE	kg Sb eq.	1.97E-04	5.37E-05
*ADPF	MJ	4.61E+03	4.89E+02
*WDP	m ³ depriv.	1.54E+01	1.40E+00
Additional environmental impact indicators (Mandatory)			
**GWP-GHG	kg CO ₂ eq.	9.99E+02	3.89E+01
Additional environmental impact indicators (Optional)			
PM	disease inc.	1.22E-05	1.48E-06
***IR	kBq U-235 eq.	3.46E+00	3.31E-01
ETP-FW	CTUe	1.45E+03	2.41E+02
*HTP - C	CTUh	1.18E-07	1.87E-08
*HTP - NC	CTUh	5.38E-06	1.81E-07
*SQP	Pt	6.38E+02	1.10E+02
Acronyms	GWP-total: Climate change, GWP-fossil: Climate change- fossil, GWP-biogenic: Climate change - biogenic, GWP-luluc: Climate change - land use and transformation, ODP: Ozone layer depletion, AP: Acidification terrestrial and freshwater, EP-freshwater: Eutrophication freshwater, EP-marine: Eutrophication marine, EP-terrestrial: Eutrophication terrestrial, POCP: Photochemical oxidation, ADPE: Abiotic depletion - elements, ADPF: Abiotic depletion - fossil resources, WDP: Water scarcity, PM: Respiratory inorganics - particulate matter, IR: Ionising radiation, ETP-FW: Ecotoxicity freshwater, HTP-c: Cancer human health effects, HTP-nc: Non-cancer human health effects, SQP: Land use related impacts, soil quality.		
Legend	A1: Raw Material Supply, A2: Transport, A3: Manufacturing, A4: Transport		

Information on biogenic carbon content according to EN 15804+A2

Biogenic carbon content in product	kg C	0
Biogenic carbon content in packaging	kg C	0

Indicators describing resource use (Mandatory)		Unit	A1-A3	A4
PERE		MJ	1.71E+02	4.63E+00
PERM		MJ	0	0
PERT		MJ	1.71E+02	4.63E+00
PENRE		MJ	4.61E+03	4.89E+02
PENRM		MJ	0	0
PENRT		MJ	4.61E+03	4.89E+02
SM		kg	5.85E+01	0
RSF		MJ	0	0
NRSF		MJ	1.67E+02	0
FW		m ³	2.65E+00	5.48E-02
Acronyms	PERE: Use of renewable primary energy excluding resources used as raw materials, PERM: Use of renewable primary energy resources used as raw materials, PERT: Total use of renewable primary energy, PENRE: Use of non-renewable primary energy excluding 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, SM: Secondary material, RSF: Renewable secondary fuels, NRSF: Non-renewable secondary fuels, FW: Net use of fresh water.			
Environmental information describing waste categories (Mandatory)		Unit	A1-A3	A4
HWD		kg	1.20E-03	0
NHWD		kg	4.27E-04	0
RWD		kg	0	0
Environmental information describing Output flow (Mandatory)		Unit	A1-A3	A4
CRU		kg	0	0
MFR		kg	0	0
MER		kg	0	0
EE (Electric)		MJ	0	0
EE (Thermal)		MJ	0	0
Acronmys	HWD: Hazardous waste disposed, NHWD: Non-hazardous waste disposed, RWD: Radioactive waste disposed, CRU: Components for reuse, MFR: Material for recycling, MER: Materials for energy recovery, EE (Electrical): Exported energy electrical, EE (Thermal): Exported energy thermal.			
*Disclaimer 1	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 experience with the indicator.			
**Disclaimer 2	GWP-GHG = Global Warming Potential total excl. biogenic carbon following IPCC AR5 methodology 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 thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013			
***Disclaimer 3	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.			

References

ISO 9001:2015/ Quality Management Systems

ISO 50001:2018/ Energy Management Systems

GPI/ General Programme Instructions of the International EPD® System. Version 4.0.

ISO 14020:2000/ Environmental Labels and Declarations — General principles

EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works - Environmental Product Declarations — Core rules for the product category of construction products

ISO 14025/ DIN EN ISO 14025:2009-11: Environmental labels and declarations - Type III environmental declarations — Principles and procedures

ISO 14040/44/ DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework (ISO14040:2006) and Requirements and guidelines (ISO 14044:2006)

PCR for Construction Products and Construction Services/ Prepared by IVL Swedish Environmental Research Institute, Swedish environmental Protection Agency, SP Trä, Swedish Wood Preservation Institute, Swedisol, SCDA, Svenskt Limträ AB, SSAB, The International EPD System, 2019:14 Version 1.2.5 DATE 2022-11-01

The International EPD® System/ The International EPD® System is a programme for type III environmental declarations, maintaining a system to verify and register EPD®s as well as keeping a library of EPD®s and PCRs in accordance with ISO 14025. www.environdec.com

Ecoinvent / Ecoinvent Centre, www.ecoinvent.org

SimaPro/ SimaPro LCA Software, Pré Consultants, the Netherlands, www.pre-sustainability.com

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