ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO14025 and EN15804 for Wall Tiles

ECO PLATFORM EPD EN 15804 VERIFIED

EPD® THE INTERNATIONAL EPD® SYSTEM

The environmental impacts of this product have been assessed over its whole life cycle. Environmental Product Declaration has been verified by an independent third party.

CPC Code	373 Refractory products and structural non-refractory clay products
ECO EPD Reg. No	00000130
Declaration Number	S-P-00631
EPD Valid from	07.01.2015
EPD Expire on	06.01.2020
Market Coverage	Worldwide

NG | KUTAHYA SERAMIK

PROGRAMME RELATED INFORMATION

EPD Programme Holder	The International EPD System www.environdec.com Valhallavägen 81, 114 27 Stockholm, Sweden
Product Category Rules (PCR)	2012:01 Version 1.2, 2013-03-15), Construction Products and CPC 54 Construction Services EN 15804:2012 + A1:2013 Sustainability of Construction Works
Generic PCR Review Conducted by	Technical Committee of the International EPD® System
Independent Verification	☐ Internal ☑ External ☐ EPD® Process Certification
Approved and Verified by	Mr Marcus Wendin http://www.miljogiraff.se
EPD Prepared by	Metsims Sustainability Consulting www.metsims.com
Calculation Procedure	SimaPro 8.0.3 Software (Metsims Sustainability Consulting)
System Boundaries	☐ Cradle to Gate ☑ Cradle to Gate with option ☐ Cradle to Grave
Disclaimer	All values provided in this Environmental Product Declaration are a direct result from the use of characterisation factors and calculation rules as defined in the SimaPro software. The environmental indicators used for these calculations are based on CML Baseline V4.2 April 2013. For more information about this Environmental Product Declaration or its contents, contact process owner, Ms Berrin Gökçek berringokcek@ngkutahyaseramik.com.tr
Demonstration of Verification	**PCR Review was conducted by:** **Technical Commitee of EPD International AB.** **Valhallavägen 81, 114 27 Stockholm, Sweden** **www.environdec.com info@environdec.com** **Independent Verification and data, according to ISO 14025;2006** Internal ☐ External ☑ **Third Party Verifier:** Mr Marcus Wendin Sodra Larmgatan 6, 411 16 Goteborg Sweden **CEN Standard EN 15804:2012 + A1:2013 Sustainability of Construction Works serves as core PCR and Construction Products and CPC 54 Construction Services (2012:01 Version 1.2, 2013-03-15) serves as specific PCR.** **Independent Verification and data, according to EN ISO 14025;2010** Internal ☐ External ☑ **Third Party Verifier:** Mr Marcus Wendin Sodra Larmgatan 6, 411 16 Goteborg Sweden

reddot design award
best of the best 2011

ELLE DECORATION INTERNATIONAL DESIGN AWARD

reddot design award
product design 2013

The COMPANY

NG Kütahya Seramik Porselen Turizm A.Ş. operates in ceramic and tourism sectors in Turkey. Ceramic products are produced and marketed under the brand of NG Kütahya Seramik.
NG Kütahya Seramik, which always sets out with the principles of quality production and product diversity, has succeeded in becoming both the leading establishment and the export leader of the sector as a result of significant investments that have taken years.
Today, thousands of NG Kütahya Seramik products are in service across Turkey and around the world.

The production ranges from 10cmx20cm to 120cmx240cm dimensions, as floor-wall tiles, glazed porcelain tiles and glass mosaics.

Following their dreams, NG Kütahya Seramik has become the first manufacturer in the world for the production of the biggest green body tiles in its Technical Granit Ceramic Factory in Kütahya, Turkey. The new investment has a covered area of 77 000 m2 with a total area of 320 000 m2.

Another feature of their new production plant is that there is no wastewater streaming to sewage system. Wastewater is processed and reused within the plant, heat from furnaces is recovered achieving 20-25% useful heat gain and no waste is generated during packaging process in the new plant. In addition, the natural gas usage in frit furnace is reduced 57% by using oxygen.
The emphasis NG Kütahya Seramik places on the quality of work, human capital and environment proven with the award of national and international standards such as TS EN ISO 9001:2008, EN 14411:2012, TSE K 149:2012.

Over the years NG Kütahya has been awarded many prestigious awards such as; Reddot Design Award “Best of the Best 2011”, Elle Decoration International Design Award “Product Design Award 2011”, “If Product Design Award Winner 2011”, “Good Design Award Winner 2012”, Reddot Design Award “Product Design Winner 2013” and for their new Technical Granit Ceramic Factory in Kütahya-Turkey that manufactures biggest ceramic tiles in the world, Sign of the City Awards Turkey “Best of the Industrial Building Award”.

NG Kütahya Seramik offers many important and innovative projects in Turkey. Besides being one of the world’s leading brands in ceramic and tourism industry, NG Kütahya Seramik is the proud main sponsor of Turkish national football team.

And now, with the aim of getting these EPDs, NG Kütahya Seramik will further strengthen their environmental awareness, while fulfilling the market requirements by declaring the environmental impacts of their products for Ceramic Wall Tiles.

STATEMENT

The LCA for this EPD is conducted according to the guidelines of ISO 14040-44, the requirements given in the Product Category Rules (PCR) document for Construction Products and CPC 54 Construction Services (PCR 2012:01 Version 1.2, 2013-03-15), EN EN 15804:2012 + A1:2013 Sustainability of Construction Works: Environmental Product Declarations and the general program guidelines by The International EPD System in accordance with ISO 14025 standards.

The inventory for the LCA study is based on the 2013 - 2014 production figures for 'Wall Tiles' from NG Kütahya Seramik's main production plant is located in Kütahya, Turkey. This LCA was modelled with SimaPro 8.0.3 LCA package using the latest version of Ecoinvent ver3.0 database and impact factors.

EPD of construction products may not be comparable if they do not comply with EN 15804 norms.

This EPD covers the Cradle to Gate stage and disposal option.

PRODUCT SPECIFICATIONS

Most ceramic products are clay-based and are made from a single clay or one or more clays mixed with mineral modifiers such as quartz and feldspar. The types of commercial clays used for ceramics are primarily kaolin and ball clay.

Wall tile is defined as glazed vitreous ceramic ware used primarily for technical purposes. Wall tiles have a water absorption of about higher than %10 by volume. They are used on internal surfaces.

The raw material composition of wall tiles are shown below.

Composition, kg	Slip	Glaze	Total
Clay	60-70%	-	60-70%
Silica sand	-	-	-
Alumina	-	3-8%	0-1%
Kaolin	5-10%	8-12%	5-10%
Potassium nitrate	-	0-2%	0-1%
Dolomite	-	7-12%	0-1%
Feldspar	10-20%	10-20%	10-20%
Wollastonite	-	-	-
Quartz	-	30-40%	1-3%
Zircon	-	5-10%	0-1%
Boric acid	-	0-3%	0-1%
Zinc	-	5-10%	0-1%
Calcite	8-15%	-	10-15%
Barium	-	0-2%	0-1%
Total	100%	100%	100%

30 x 75 cm / 12 x 30"

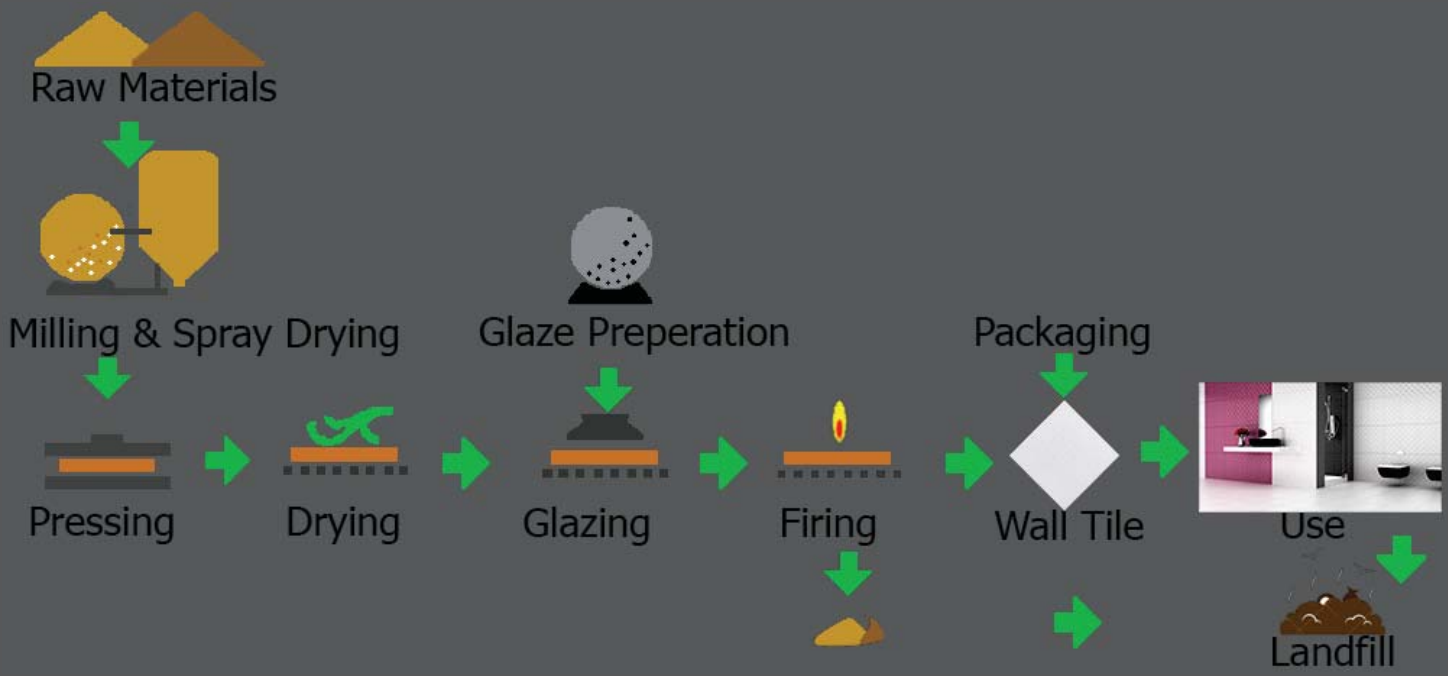
TECHNICAL PROPERTIES	TURKISH & EUROPEAN STANDARDS	STANDARD NUMBER
	EN 14411 Annex K Group BIII Eb > 10 %	TEST METHOD
Lenght and width	7 cm ≤ N < 15 cm ± 0,75 mm N ≥ 15 cm ± 0,5 % ± 2,0 mm	EN ISO 10545-2
Thickness	7 cm ≤ N < 15 cm ± 0,5 mm N ≥ 15 cm ± 10 % ± 0,5 mm	EN ISO 10545-2
Straightness of sides	7 cm ≤ N < 15 cm ± 0,5 mm N ≥ 15 cm ± 0,3 % ± 1,5 mm	EN ISO 10545-2
Rectangularity	7 cm ≤ N < 15 cm ± 0,75 mm N ≥ 15 cm ± 0,5 % ± 2,0 mm	EN ISO 10545-2
Surface flatness (curvature)	7 cm ≤ N < 15 cm +0,75mm / -0,50mm N ≥ 15 cm +0,5% / -0,3% +2,0 / -1,5mm	EN ISO 10545-2
Water absorption	Eb > 10 %	EN ISO 10545-3
Breaking strenght	Thickness ≥ 7,5 mm not less than 600 N Thickness < 7,5 mm not less than 200 N	EN ISO 10545-4
Flexural tensile strenght	Thickness ≥ 7,5 mm Min. 12 N/mm^2 Thickness < 7,5 mm Min. 15 N/mm^2	EN ISO 10545-4
Coefficient of linear thermal expansion	Declared value	EN ISO 10545-8
Thermal shock resistance	Pass	EN ISO 10545-9
Crazing resistance	Pass	EN ISO 10545-11
Bond strenght (cementitious adhesives)	Declared value	EN 12004:2007+A1
Moisture expansion	Declared value	EN ISO 10545-10
Small colour differences (for plain coloured tiles)	Glazed tiles $\Delta E_{cmc} < 0,75$	EN ISO 10545-16
Reaction to fire	Class A1	-
Resistance to staining	Glazed tiles min. Class 3 Unglazed tiles declared value	EN ISO 10545-14
Resistance to chemicals	Low and high concentrations of acids and alkalis: Declared Value Household chemicals and swimming pool salts min. Class B	EN ISO 10545-13
Release of dangerous substances	Declared value	EN ISO 10545-15

PRODUCTION PROCESS

The basic steps of manufacturing wall tiles include raw material procurement, beneficiation, milling, spray drying, pressing (forming), drying, glazing, firing, and packaging.

Manufacturing starts with raw materials preparation followed by granule formation by spray drying. Spray dried powders are formed to a green body or so called 'biscuits'. Access humidity within the body is removed by drying under heat. The green body tiles, glazed if required, are then fired around 1135°C for Wall tiles. After quality control, the end products are then packaged and dispatched.

The system boundary of the LCA study conducted on the product groups of Wall Tiles is shown below including packaging of the final product for delivery.



System Boundary of the LCA study conducted on Ceramic Wall Tiles

LCA RESULTS

Description of the system boundary (X = Included in LCA, MND = Module Not Declared)

PRODUCT STAGE			CONSTRUCTION PROCESS		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	Operational energy use	Operational water use	De-construction	Transport	Waste processing	Disposal	Reuse- Recycling - Recovery Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	MND

Upstream Processes (A1: Raw Material Supply)

In this report, for each product group production starts with raw materials, mainly locally sourced but some transported from other parts of the world. 'Raw material supply' includes raw material extraction and pre-treatment processes before production.

Core Processes (A2:Transportation and A3: Manufacturing)

Transport' is only relevant for raw materials delivery to the plant and forklift usage within the factory.

Manufacturing stage involves milling, spray drying, forming, glazing, firing and packaging. Natural gas and electrical energy are the two energy sources.

Downstream Processes (C4: Disposal)

All ceramic products end up at landfill as their final fate and modelled as such for this EPD. There is no open loop recycling within the manufacturing. Packaging waste is modelled according to Turkish Packaging and packaging waste Directive.

Benefits and loads beyond the product system boundary in information Module D

No possible benefits of recycling and re-use were taken into account in the LCA work here. Wall tiles have similar fate to demolition waste and they tend to end up at C&D landfills unless they are recovered.

LCA CALCULATION RULES

Functional Unit/ Declared Unit	The declared unit is the production of 1 m^2 of Wall tiles with an average weight of approximately 16 kg.
Goal and Scope	This EPD evaluates the environmental impacts of 1 m^2 Wall tiles from cradle to gate with disposal.
System Boundaries	The system boundary covers A1 – A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing' and C4 as Disposal.
Estimates and Assumptions	There are no additional product scenarios developed for this EPD. However, very small amount of packaging waste for the wall tiles are modelled based on the 44% collection rate enforced by law in Turkey.
Cut - Off Rules	Raw materials that are also a minor constituent of the Wall Tiles amounting less than 1% of total raw materials such as colouring agents are excluded in this study.
Background Data	Ecoinvent ver.3.0 were used as generic background data source.
Data Quality	Raw materials, electricity, water use and waste data all primary data is collected from NG Kütahya's plant for 2013-2014. Primary datasets were produced in SimaPro using these data. Localized data for Turkey based on Ecoinvent database developed by Metsims Sustainability Consulting were used where relevant.
Period Under Review	2013 - 2014 production figures for Wall Tiles.
Allocations	There are no co-products in the production of Ceramic Wall Tiles. Hence, there is no need for co-product allocation.
Comparability	A comparison or an evaluation of EPD data is only possible when EN 15804 has been followed, and the same building context and product-specific characteristics of performance are taken into account and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard.

ENVIRONMENTAL IMPACTS

Indicators for the Life Cycle Analysis as per EN15804

The results of the LCA with the indicators as per EPD requirement are given in the following tables for product manufacture (A1-A3) and disposal (C4). The system boundaries in tabular form for all modules are shown in the table above. Life Cycle Inventory Analysis indicators describing the use of resources are shown below.

Parameter	Unit	Raw Material	Transport	Manufacturing	Disposal
Energy			A1 - A3		C4
Use of Renwable Primary Energy Excluding Resources	MJ		0.054		0
Use of Renewable Primary Energy Resources Used as Raw Materials	MJ		0		0
Total Use of Renewable Primary Energy Resources	MJ		**0.054**		**0**
Use of non-renewable Primary Energy Excluding Resources	MJ		155		3
Use of non-renewable Primary Energy Resources Used as Raw Materials	MJ		0		0
Total Use of non-renewable Primary Energy Resources	MJ		**155**		**3**
			A1 - A3		C4
Use of Secondary Material	kg		0		0
Use of Renewable Secondary Fuels	MJ		0		0
Use of non-renewable Secondary Fuels	MJ		0		0
Water			A1 - A3		C4
Use of Net Fresh Water	m3		0.165		0.002

Results of the LCA - Resource use for 1 m^2 of Wall tiles

Table below depicts the contributions in the production of 1 m^2 ceramic Wall tiles, to the following impact categories, calculated using CML-IA baseline (v4.2) methodology: Global warming potential (GWP), ozone depletion potential (ODP), formation potential of tropospheric ozone photochemical oxidants, acidification potential, eutrophication potential, abiotic depletion potential for non-fossil resources and abiotic depletion potential for fossil resources.

Parameter	Unit	Raw Material	Transport	Manufacturing	Disposal
			A1 - A3		C4
Global Warming Potential	[kg CO2 eq.]		10.8		0.195
Ozone Deplation Potential	[kg CFC11 eq.]		6.20E-07		1.23E-08
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene eq.]		2.11E-03		5.99E-05
Acidification Potential	[kg SO2 eq.]		3.28E-02		7.40E-04
Eutrophication Potential	[kg PO43- eq.]		1.07E-02		1.05E-03
Abiotic deplation potential for non-fossil resources	[kg Sb eq.]		7.10E-06		1.28E-07
Abiotic deplation for fossil resources	[MJ eq.]		1.50E+02		2.85E+00

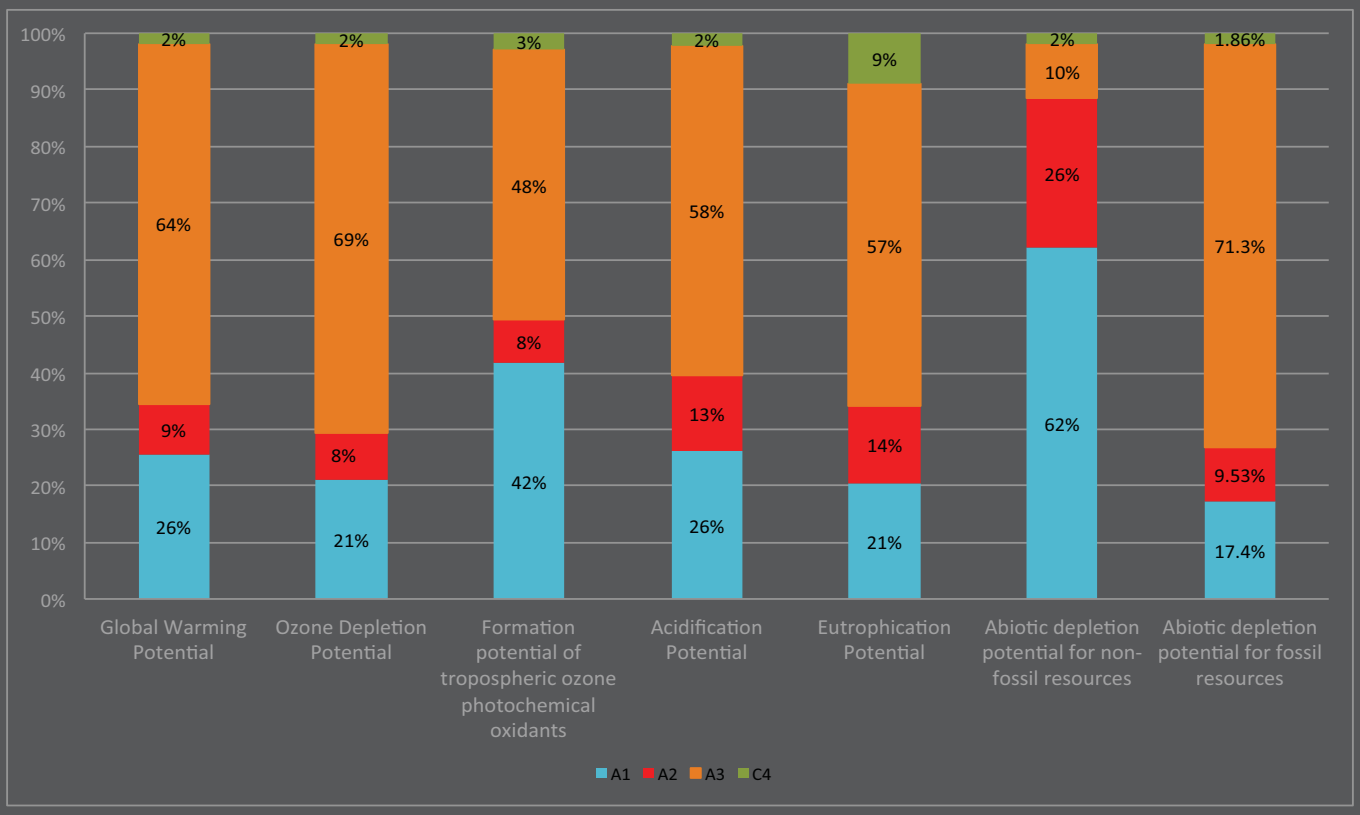
LCA Environmental Impacts for 1 m^2 of Wall tiles

Table below shows the impacts for ceramic Wall tiles according to the following categories: Hazardous waste disposed (HWD), Non-hazardous waste disposed (NHWD), Radioactive waste disposed (RWD), Components for re-use (CRU), Materials for recycling (MFR), Materials for energy recovery (MER), Exported energy per energy carrier (EE).

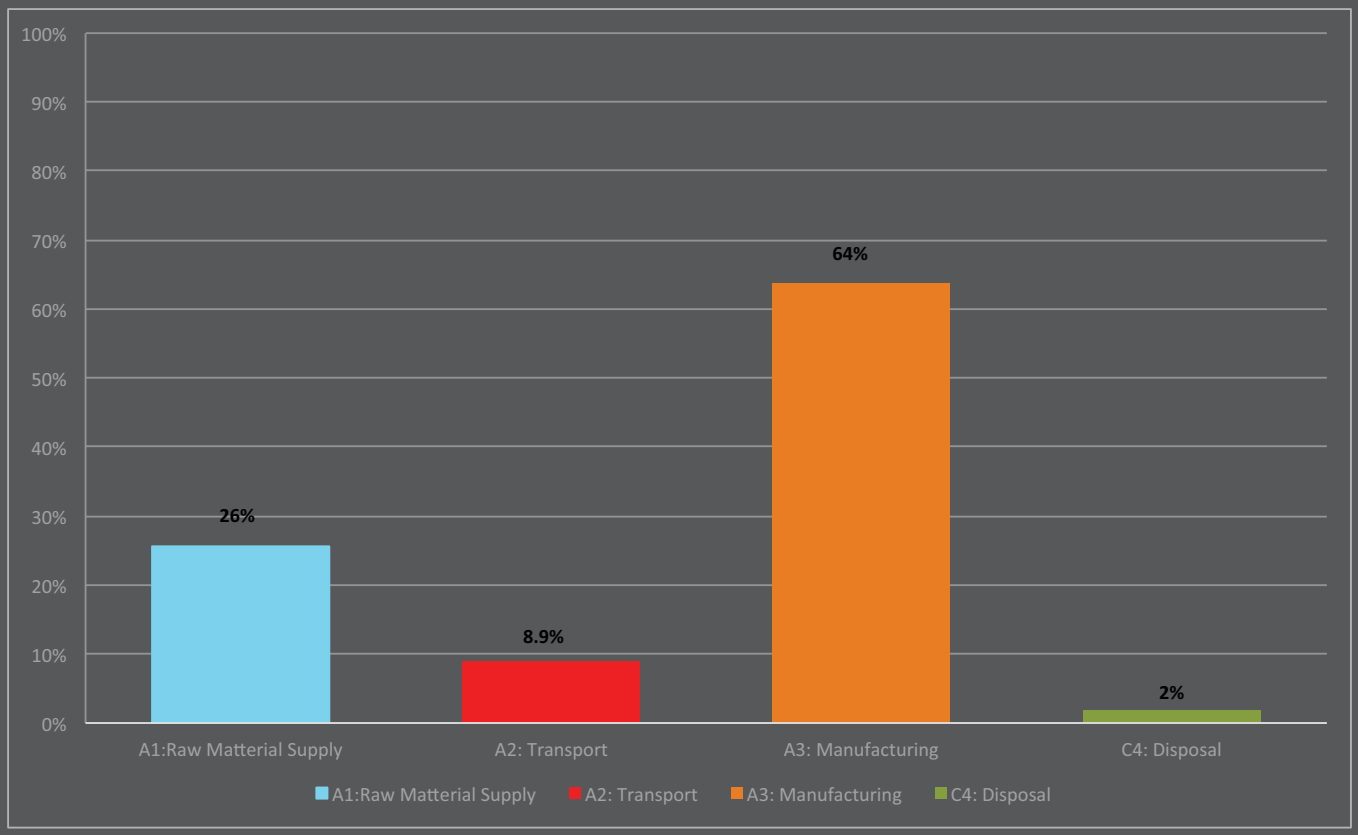
Parameter	Unit	Raw Material	Transport	Manufacturing	Disposal
			A1 - A3		C4
HWD	[kg]		7.79E+00		0
NHWD	[kg]		1.90E-04		16
RWD	[kg]		0		0
CRU	[kg]		0.187		0.187
MFR	[kg]		0.0528		0.0672
MER	[kg]		0		0
EE [Typ]	[MJ]		0		0

Output flows and waste categories for 1 m^2 of Wall tiles

ENVIRONMENTAL INTERPRETATIONS



Relative impacts of LCA stages by each EPD indicator of Wall tiles



Global Warming Potential (IPCC GWP100a) kg CO2 eq. of Wall tiles

Among all impact categories except eutrophication potential, manufacturing (A3) represents the life cycle stage with the highest impact. The GWP of manufacturing is 64%, while raw materials has about 26% of the total carbon emissions followed by transport with 9% of the impact. The carbon impact of 1 m^2 Wall tiles manufactured by NG Kütahya is 11 kg CO_2 eq.

Manufacturing has about 69% of ODP impacts, followed by transport (8%) and raw material supply (21%). The ODP impact of 1 m^2 Wall tiles manufactured by NG Kütahya is 6.32E-07 kg CFC11 eq.

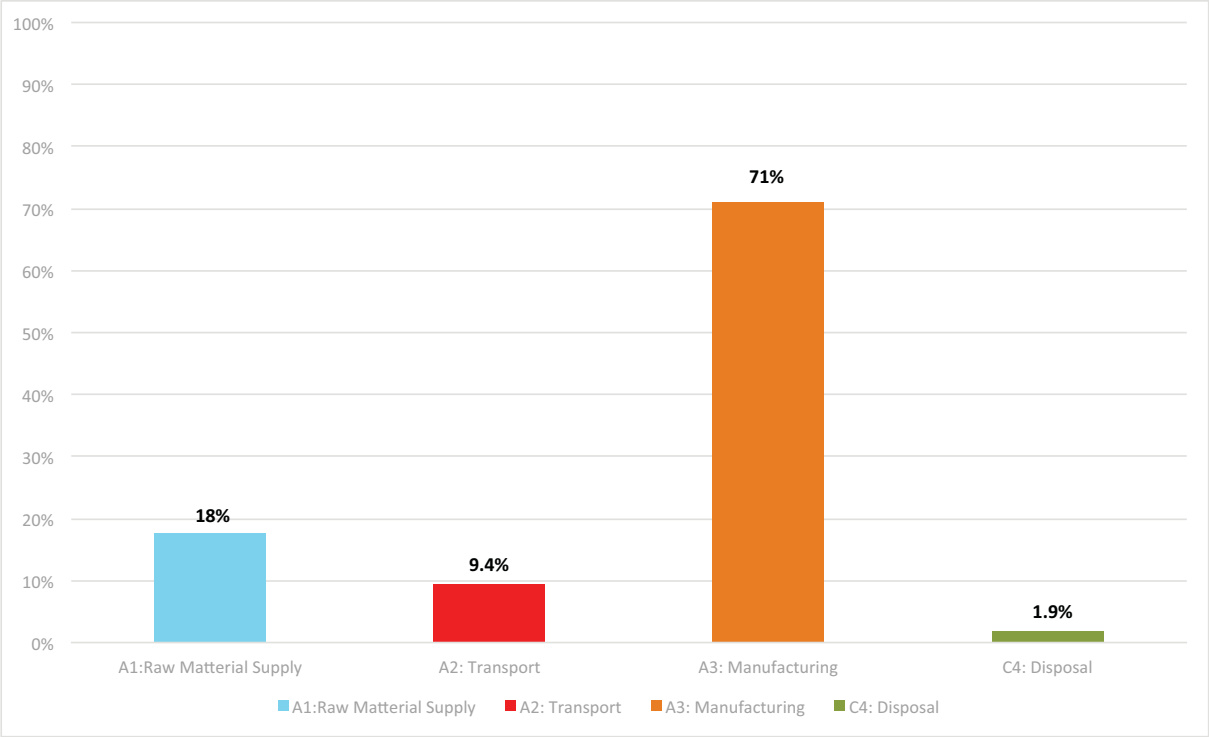
Manufacturing has about 48% of the photochemical oxidation impacts, followed by the raw material supply and transport, with about 42% and 8%, respectively. The photochemical oxidation impact of 1 m^2 Wall tiles manufactured by NG Kütahya is 0.00217 kg C_2H_4 eq.

Acidification impact of manufacturing is about 58%, while that of raw material supply 26% and transport with13%. The acidification impact of 1 m^2 Wall tiles manufactured by NG Kütahya is 0.0336 kg SO_2 eq.

Eutrophication is dominated by manufacturing (57%) followed by the raw material supply (21%) and transport (14%). The eutrophication impact of 1 m^2 Wall tiles product manufactured by NG Kütahya is 0.0117 kg PO_4^{---} eq.

Raw materials supply has about 62% of abiotic depletion impacts while that of transport is only 26%. Manufacturing is about 10%. Burden from end of life is around 2%. The abiotic depletion impact of 1 m^2 Wall tiles product manufactured by NG Kütahya is 7.22E-06 kg Sb eq.

The non-renewable fossil fuel has the highest impact from manufacturing (71.3%) followed by 17.4% impact from the raw material supply. Transport and end of life have very low impact about 9.53% and 1.86%. The non-renewable fossil impact of 1 m^2 Wall tiles product manufactured by NG Kütahya is 153 MJ eq.



Total Energy Contributions to each life cycle stage for Wall tiles

REFERENCES

/ISO 9001/ DIN EN ISO 9001:2008, Quality Management System - Requirements

/EN 14411/ Ceramic tiles - Definitions, classification, characteristics and marking

/TSE K 149/ Glass mosaics: Definitions, requirements, sampling, inspection and test methods and supplying to the market of glass mosaics.

/EN 15804/ EN 15804:2012+A1:2013, Sustainability of construction works - Environmental Product Declarations — Core rules for the product category of construction products

/EN ISO 10545-2/ Technical Standard for Ceramic Tiles - Part 2: Determination of dimensions and surface quality

/EN ISO 10545-3/ Technical Standard for Ceramic Tiles - Part 3. Determination of water absorption apparent porosity, apparent relative density and bulk density

/EN ISO 10545-4/ Technical Standard for Ceramic Tiles - Part 4: Determination of modulus of rupture and breaking strength

/EN ISO 10545-7/ Technical Standard for Ceramic Tiles - Part 7: Determination of resistance to surface abrasion for glazed tiles

/EN ISO 10545-8/ Technical Standard for Ceramic Tiles - Part 8: Determination of linear thermal expansion

/EN ISO 10545-9/ Technical Standard for Ceramic Tiles - Part 9: Determination of resistance to thermal shock

/EN ISO 10545-11/ Technical Standard for Ceramic Tiles - Part 11: Determination of crazing resistance for glazed tiles

/EN ISO 10545-13/ Technical Standard for Ceramic Tiles - Part 13: Determination of chemical resistance

/EN ISO 10545-14/ Technical Standard for Ceramic Tiles - Part 14: Determination of resistance to stains

/EN 101/ Ceramic Tiles - Determination of Scratch Hardness of Surface According to Mohs

/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 (ISO 14040:2006) and Requirements and guidelines (ISO 14044:2006)

/PCR for Construction Products and CPC 54 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, 2012:01 Version 1.2, DATE 2013-03-15

/PCR for Glass and glass products and other nonmetallic products n.e.c. and CPC 373 Refractory products and structural non-refractory clay products/ 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, 2012:01 Version 2,

/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.Eco-invent.org

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

VERIFICATION & REGISTRATION CONTACTS

Programme Holder

The International EPD System
PCR Review Conducted by:Technical Committee of EPD International AB.
Valhallavägen 81, 114 27 Stockholm, Sweden
www.environdec.com

Programme Holder

EPD Turkey
Based on The International EPD System
Veko Giz Plaza, Meydan Sok.
No 3 Kat 13 Maslak,
Istanbul Turkey
www.epdturkey.org

Third Party Verifier

Miljogiraff
Third Party Verifier of this EPD Declaration
Mr Marcus Wendin
Sodra Larmgatan 6,
411 16 Goteborg Sweden
www.miljogiraff.se

Owner of the Declaration

NG Kütahya Seramik Porselen Turizm A.Ş.
Çalca Mahallesi, 43001, Kütahya
Turkey
www.ngkutahyaseramik.com.tr

LCA Author and Graphic Design

Metsims Sustainability Consulting
Elmas Studio Levent
Sanayi Mah. Sultan Selim Cad.
Lalegul Sok. No:7 D:18
34415 4. Levent Istanbul,
Turkey
www.metsims.com

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ngkutahyaseramik.com.tr