ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	**Kunda Nordic Tsement AS**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KNT-20220064-CAA1-EN
Issue date	27/04/2022
Valid to	26/04/2027

Portland Cement CEM I 42,5 R

Kunda Nordic Tsement AS, HeidelbergCement Group

Institut Bauen und Umwelt e.V.

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ECO PLATFORM EPD VERIFIED

General Information

Kunda Nordic Tsement AS, HeidelbergCement Group

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Declaration number
EPD-KNT-20220064-CAA1-EN

This declaration is based on the product category rules:
Cement, 11.2017
(PCR checked and approved by the SVR)

Issue date
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Valid to
26/04/2027

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

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(Managing Director Institut Bauen und Umwelt e.V.))

Portland Cement CEM I 42,5 R

Owner of the declaration
Kunda Nordic Tsement AS
Jaama 2, Kunda
44106
Estonia

Declared product / declared unit
1 metric t of CEM I 42,5 R

Scope:
This Environmental Product Declaration (EPD) covers the product life cycle stages A1-A3. It is valid for Portland Cement CEM I 42,5 R, manufactured by Kunda Nordic Tsement AS in the plant Kunda, Estonia in 2021. This analysis relies on transparent, plausible and documented basis data. All the model assumptions, which influence the results, are declared. The life cycle assessment is representative for the products introduced in the declaration for the given system boundaries.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2010*
☐ internally ☒ externally

Angela Schindler
(Independent verifier)

Product

Information about the enterprise
Kunda Nordic Tsement AS is a company with the history of 150 years. Kunda Nordic Tsement produces constructional cements and crushed limestone. Kunda Nordic Tsement AS is a member of HeidelbergCement Group, which is the global market leader in aggregates and a prominent player in the fields of cement, concrete and other downstream activities, making it one of the world's largest manufacturers of building materials.

Product description/Product definition
Cement is a hydraulic binder. It consists of finelyground, non-metallic inorganic compounds. Cement is produced by grinding cement clinker and other main or minor constituents. When water is added to cement, a cement paste is formed, which sets and hardens through hydration reactions. After hardening, it retains its strength and stability even under water.

The declared product is a cement conforming with the composition of Portland Cement CEM I 42.5 R manufactured by Kunda Nordic Tsement AS in the plant Kunda in 2021. The calculation is based on plant-specific data.

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Construction Product Regulation *(EU) No 305/2011* applies. The product needs a declaration of performance taking into consideration *EN 197-1*, composition specification and conformity criteria for common cements and the CE-marking. For the application and use the respective national provisions apply.

Application
The application of cement has a large variety. It is mainly used as a binder for concrete and mortar. The

application in concrete is regulated in *EN 206*. According to this standard, general suitability is established for cement conforming to *EN 197-1.*

Technical Data
The declared cement corresponds to the 42.5 standard compressive strength class with high early strength development (R) in accordance with *EN 197-1*.

Constructional data

Name	Value	Unit
Strength class acc. to EN 197-1	42.5	N/mm²

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 197-1,* Composition specification and conformity criteria for common cements.

Base materials/Ancillary materials
Clinker: 95-100 %
Cement clinker is made of a raw material mixture that is added to the cement kiln and sintered at a temperature of 1400 °C.The basic materials for the production of cement clinker consist of calcium oxide (CaO), silicon dioxide (SiO_2) and small amounts of aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3). Raw materials that provide these constituents are limestone, chalk and clay or limestone marl as its natural occurring mixture.

Gypsum/Anhydrite/Residual gypsum: 0 - 5 %
Gypsum and anhydrite are added as setting regulators to cement. Many cement plants use residual gypsum from flue gas desulfurization as well.
This product contains substances listed in the *candidate list* (date: 20.11.2020) exceeding 0.1 percentage by mass: no

Reference service life
This study covers the production stage information (from A1 to A3) of the product. As no use stage is declared, the reference service life for cement is irrelevant.

LCA: Calculation rules

Declared Unit
The declared unit is 1 metric t of CEM I 42,5 R

Declared unit

Name	Value	Unit
Declared unit	1	t

System boundary
Type of EPD: cradle-to-gate (A1-A3)
For the modelling of cement, both specific production data from HeidelbergCement and background data (especially for upstream processes) have been used. For life cycle modelling of the considered product, the verified Global Cement and Concrete Association *GCCA* Core model report and *GCCA* Project Database for EPDs of concrete and cement is used. The tool was developed by *Quantis* and is owned by the Global Cement and Concrete Association. The life cycle assessment in the tool has been implemented in compliance with *EN 15804,* the General Programme Instructions *(GPI 3.01)* for the International EPD® System, the product category rules *c-PCR-003 Concrete* and *c-PCR-001 Cement.* For the present study, version 3.1 of the GCCA Concrete EPD tool was used, largely being based on the database *ecoinvent v3.5*
A significant factor regarding primary data collection is the emission measurement directly at the plant. In line with the official regulations, regular data collections are established at HeidelbergCement group. The emission data of the clinker burning process are included in this LCA study. Preferably directly measured kiln emission values in the specific plant are considered. Noise, landscape impact, vibration etc. are not within the scope of this study. In case specific kiln emission data are not available, default values are automatically used by the GCCA tool.
The selected system boundaries comprise the production of cement including raw material extraction up to the finished product at the factory gate.
The product stage contains:
Module A1: Extraction and processing of raw materials.
Module A2: Transport of raw materials to the factory gate and internal transport.
Module A3: Cement production.
The construction stage, the use stage and the disposal stage are not included in the life cycle assessment of cement.

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

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LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon
Not applicable

The development of scenarios has to be made on the finished product (e.g. concrete) and not on the upstream product cement.

LCA: Results

Disclaimer:
EP-freshwater: This indicator has been calculated as “kg P eq” as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	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	ND	ND	ND	ND	MNR	MNR	MNR	ND	ND	ND	ND	ND	ND	ND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 metric t CEM I 42,5 R

Core Indicator	Unit	A1-A3
Global warming potential - total	[kg CO_2-Eq.]	7.87E+2
Global warming potential - fossil fuels	[kg CO_2-Eq.]	7.86E+2
Global warming potential - biogenic	[kg CO_2-Eq.]	1.98E-1
GWP from land use and land use change	[kg CO_2-Eq.]	9.52E-2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	8.95E-6
Acidification potential, accumulated exceedance	[mol H^+-Eq.]	1.58E+0
Eutrophication, fraction of nutrients reaching freshwater end compartment	[kg PO_4-Eq.]	7.15E-2
Eutrophication, fraction of nutrients reaching marine end compartment	[kg N-Eq.]	5.43E-3
Eutrophication, accumulated exceedance	[mol N-Eq.]	4.61E+0
Formation potential of tropospheric ozone photochemical oxidants	[kg NMVOC-Eq.]	1.25E+0
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.59E-4
Abiotic depletion potential for fossil resources	[MJ]	2.42E+3
Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world-Eq deprived]	2.60E+1

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 metric t CEM I 42,5 R

Indicator	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	2.27E+2
Renewable primary energy resources as material utilization	[MJ]	0.00E+0
Total use of renewable primary energy resources	[MJ]	2.27E+2
Non-renewable primary energy as energy carrier	[MJ]	2.42E+3
Non-renewable primary energy as material utilization	[MJ]	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	2.42E+3
Use of secondary material	[kg]	1.05E+2
Use of renewable secondary fuels	[MJ]	7.40E+2
Use of non-renewable secondary fuels	[MJ]	1.21E+3
Use of net fresh water	[m^3]	6.47E-1

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 metric t CEM I 42,5 R

Indicator	Unit	A1-A3
Hazardous waste disposed	[kg]	ND
Non-hazardous waste disposed	[kg]	ND
Radioactive waste disposed	[kg]	ND
Components for re-use	[kg]	0.00E+0
Materials for recycling	[kg]	0.00E+0
Materials for energy recovery	[kg]	0.00E+0
Exported electrical energy	[MJ]	0.00E+0
Exported thermal energy	[MJ]	0.00E+0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 metric t CEM I 42,5 R

Indicator	Unit	A1-A3
Potential incidence of disease due to PM emissions	[Disease Incidence]	1.64E-5
Potential Human exposure efficiency relative to U235	[kBq U235-Eq.]	3.72E+4
Potential comparative toxic unit for ecosystems	[CTUe]	4.55E+1
Potential comparative toxic unit for humans - cancerogenic	[CTUh]	1.11E-6
Potential comparative toxic unit for humans - not cancerogenic	[CTUh]	9.75E-6
Potential soil quality index	[-]	1.19E+3

Remark to Global warming potential:
This includes 138.7 kg CO_2-eq. from the incineration of wastes in clinker production. According to the polluterpays principle *EN 15804* that would be assigned to the production system, which has caused the waste. In this EPD the CO_2 contribution is not subtracted. This is to ensure comparability across countries of calculated global warming potentials for cements even if the used secondary fuels in other countries do not have waste status.

Remark to Waste categories:
The waste indicators account for wastes from clinker and cement manufacturing only.

Disclaimer 1 – for the indicator potential Human exposure efficiency relative to U235.This impact category deals mainly with the eventual impact of low dose ionizingradiation on human health of the nuclear fuel cycle. It does not consider effects due to possiblenuclear accidents, occupational exposure nor radioactive waste disposal in undergroundfacilities. Potential ionizing radiation from the soil, radon and some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators: abiotic depletion potential for fossil resources, abiotic depletion potential for non-fossil resources, water (user) deprivation potential, deprivation-weighted water consumption, potential comparative toxic unit for ecosystems, potential comparative toxic unit for humans - cancer effects, potential comparative toxic unit for humans – non-cancer effects, potential soil quality index.The results of this environmental impact indicator shall be used with care as theuncertainties on these results are high or as there is limited experience with the indicator.

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