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EPD® THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM EPD VERIFIED

MARMOLINE ADVANCED BUILDING MATERIALS

NORDIA

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025:2006 & EN 15804:2012 + A2:2019 / AC:2021

Cement-based grouts & concrete repair products by NORDIA S.A.

EPD of multiple products based on the average results of the product group.
This EPD covers more than 10 products.
A detailed list of products can be found between pages 6 and 9.

EPD Registration Number
S - P - 09972

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Program Operator
EPD International AB

UN CPC
375: Articles of concrete, cement and plaster

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PROGRAM INFORMATION

PROGRAM OPERATOR: EPD International AB

ADDRESS: Box 210 60, SE-100 31 Stockholm, Sweden

WEBSITE: www.environdec.com

E-MAIL ADDRESS: info@environdec.com

EPD OWNER: Nordia S.A

FACILITY – PRODUCTION SITE & HEADQUARTERS: 1km of provincial road Markopoulos - Oropos, Polydendri, 190 11 , Greece

TELEPHONE: +30 (0) 22950 22225

WEBSITE: www.marmoline.gr

EMAIL ADDRESS: info@nordia.gr

- The EPD owner has the sole ownership, liability, and responsibility for the EPD.

PRODUCT CATEGORY RULES (PCR)	▪ CEN Standard EN 15804 serves as the Core Product Category Rules (PCR) ▪ PCR 2019:14 Construction products version 1.3.1 (EN 15804:A2)
PCR REVIEW WAS CONDUCTED BY	The technical Committee of the International EPD ® System. See www.environdec.com/TC for a list of members. Chair: No Chair Appointed Contact via: info@environdec.com
LCA ACCOUNTABILITY	SustChem Technical Consulting S.A. www.sustchem.gr
INDEPENDENT THIRD-PARTY VERIFICATION OF THE DECLARATION AND DATA, ACCORDING TO ISO 14025:2006, VIA	✓ EPD verification by accredited certification body
THIRD PARTY VERIFICATION	Business Quality Verification P.C. is an approved certification body accountable for the third-party verification www.bqv.gr – info@bqv.gr
THE CERTIFICATION BODY IS ACCREDITED BY	Hellenic Accreditation System ESYD with accreditation number 1218
PROCEDURE FOR FOLLOW-UP OF DATA DURING EPD VALIDITY INVOLVES THIRD PARTY VERIFIER	YES ✓ NO

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, 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. For further information about comparability, see EN 15804 and ISO 14025.

COMPANY INFORMATION

VISION

NORDIA S.A. is a prominent company with extensive expertise in the building materials industry, actively engaged in the following sectors:

- Production and construction of construction chemicals and mortars under the MARMOLINE brand.
- Production of concrete admixtures as an authorized licensee of the French multinational CHRYSO.
- Quarrying, processing, and sales of marble under the NORDIA MARBLE brand.

The company's objective is to cater to the construction sector's diverse needs, ranging from home renovations to large-scale new developments. Its foundation lays back in 1998 by establishing a manufacturing plant for construction mortars in Dionyssos, Attica. Dionyssos marble dust, a unique raw material featured in most of their products even today, played a significant role in the development of a product line focused on ready-to-use mortars, with particular emphasis on ready-to-use renders and tile adhesives.

Environmental Commitment

Each product is designed and produced according to the following principles:

- Raw material saving and recycling.
- Energy saving.
- Zero environmental pollution.
- Clean and tidy building site.

EMBLEMATIC CONSTRUCTIONS

- *Stavros Niarchos Foundation Cultural Center*
- *The New Acropolis Museum*
- *Athens Conservatoire*
- *Basil & Elise Goulandris Foundation*
- *Ayia Sofia Arena Stadium - AEK*
- *Tae Kwo Do Arena*
- *Olympic Velodrom*
- *Megaron the Athens Concert Hall*
- *Grand Resort Lagonissi*

VALUES

The company's dedication is to create top-notch, user-friendly materials while maintaining a strong commitment to environmental responsibility. It adheres to the ISO 14001 standard for Environmental Management Systems, implement innovative and secure production processes, and employ state-of-the-art production facilities with ISO 9001-certified Quality Management. These measures ensure the production of high-quality products that conform to European Commission standards and meet the specific requirements of the countries where the products are distributed.

Its primary focus is on delivering safe, user-friendly, and environmentally responsible products for both residential and commercial developments. The company's team stands out for their exceptional scientific knowledge and professional expertise. Its main objective is to continually seek new knowledge to stay at the forefront of technological advancements. Concurrently, it prioritizes the development of its workforce's skills and foster a culture of teamwork and respect.

PRODUCT INFORMATION

This Environmental Product Declaration (EPD) primarily aims to convey the environmental impacts linked to the manufacturing of **Cement-based Grout and Concrete Repair Products** offered by **Nordia S.A.**

A CONCISE OVERVIEW AND DESCRIPTION OF NORDIA'S CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCTS

The examined products comprise of two main subcategories, them being Cement-based Grouts and Cement-based Concrete Repair Both subcategory products are high-performance, flexible products, available for multiple application purposes, such as bonding of absorbent and non-absorbent tiles, joint-filling of firebricks, fixing marble and lass surfaces, as well as decorative and natural stone surfaces. All products consist mainly of high-strength Portland Cement (I-52.5N), granulometric graded aggregates, various chemical additives, and polymer components, which impart products with impeccable mechanical strength.
High-quality materials and production process, guarantee a high-strength product that will prevent cracking, has excellent adhesion, is easy during its installation process, is moisture- and frost-proof and can used both indoors and outdoors.
All products are classified in terms of their Reaction to Fire (RtF) and are CE certified according to EN 998-1:2016 standards.

TECHNICAL SPECIFICATIONS

CEMENT-BASED GROUTS

DESCRIPTION	CONTROL NORM	ARMOS 0-2MM	ARMOS 1-6MM	ARMOS 6-20MM
FORM	-	Cementious powder	Cementious powder	Cementious powder
Color	-	White	24 colour variations	4 colour variations
Packaging	-	Pallets Plastic Bags (5kg) Cartonboxes	Pallets Plastic Bags (5kg) Cartonboxes	Pallets Plastic Bags (5kg) Cartonboxes
Water Demand		1-1.3kg/Lt per 5kg	1-1.3kg/Lt per 5kg	1-1.3kg/Lt per 5kg
Application Temperature		From + 5 ºC to + 35 ºC	From + 5 ºC to + 35 ºC	From + 5 ºC to + 35 ºC
Abrasion Resistance		≤1000mm^3	≤1000mm^3	≤1000mm^3
Compressive Strength (28 Days)		>30MPa	>30MPa	>30MPa
Flexural Strength (28 Days)		>5MPa	>5MPa	>5MPa

PRODUCT INFORMATION

MARMOLINE

TECHNICAL SPECIFICATIONS				
CEMENT-BASED CONCRETE REPAIR PRODUCTS				
DESCRIPTION	**CONTROL NORM**	**THIXOCRETE**	**REPACRETE**	**FLUIDCRETE**
Form	-	Cementious powder	Cementious powder	Cementious powder
Color	-	Grey	Grey	Grey
Packaging	-	Paper bags (25kg) Pallets Plastic Bags (5kg) Cartonboxes	Paper bags (25kg) Pallets Plastic Bags (5kg) Cartonboxes	Paper bags (25kg) Pallets Plastic Bags (5kg) Cartonboxes
Water Demand	-	$4^{O}C$	$3.5^{O}C$	$4^{O}C$
Application Temperature	-	From + 5 ^{O}C to + 35 ^{O}C	From + 5 ^{O}C to + 35 ^{O}C	From + 5 ^{O}C to + 35 ^{O}C
Compresive Strength	EN 1504-3:2005 § 5, table 3 EN 12190	>45MPa	>30MPa	>45MPa
Adhesive Bond	EN 1504-3:2005 § 5, table 3 EN 1542	≥2MPa	≥1.5Mpa	≥2MPa
Restrained Shrinkage / Expansion	EN 1504-3:2005 § 5, table 3 EN 12617-4	≥2GPa	≥1.5GPa	≥2GPa
Elastic Modulus	EN 1504-3:2005 § 5, table 3 EN 13057	≥20kg/$m^2h^{0.5}$	≥15kg/$m^2h^{0.5}$	≥20kg/$m^2h^{0.5}$
Reaction to Fire	EN 1504-3:2005 § 5.5	Class A1	Class A1	Class A1

NORDIA

PRODUCT INFORMATION

ARMOS 0 – 2 MM is a ready white super fine-grained mortar, for the joint filling (grouting) of marbles. Based on high strength Portland white cement (I - 52.5) and selected quartz aggregates and additives to improve adhesion to very small joints. It is abrasion resistant and does not come off from the sides of tiles and marbles.
• High strength • Excellent adhesion • Moisture- and frost-proof • Incomparable quality of raw materials • Easy to apply - simply add water • Fast - clean • Indoor and outdoor use • Grinding-resistant (refers to joint-filling of marbles).

ARMOS 6 – 20 MM is a ready industrial mortar for the joint-filling (grouting) of all types of ceramic tiles, absorbent or not, for 6 - 20 mm joints. Based on high-strength Portland white cement (I - 52.5) and selected quartz aggregates and additives to improve adhesion and workability.
• High mechanical strength - rough surface (abrasion-resistant)
• Durable, moisture - and frost-proof
• Homogeneous quality • Excellent adhesion • Homogeneous quality • Incomparable quality of raw materials • Simply add water • Fast and easy to apply • Indoor and outdoor use. • Stain-free and easy to clean.

ARMOS 1 – 6 MM is a ready industrial mortar for the joint-filling (grouting) of all types of ceramic tiles, absorbent or not, as well as marble slabs & tiles, for joints up to 6 mm. It is based on high-strength Portland white cement (I - 52.5) and selected marble & quartz aggregates and additives to improve adhesion and workability.
• High mechanical strength • Excellent adhesion • Indoor and outdoor use • Moisture - and frost-proof
• Homogeneous quality • Incomparable quality of raw materials • Fast and easy to apply • Stain-free and easy to clean • Available in a wide variety of colors.

PRODUCT INFORMATION

THIXOCRETE is a single component, high strength, shrinkage compensated, fiber reinforced, thixotropic mortar, suitable for concrete repairs with layer thickness 10-40mm. It is suitable for:

- Repairs of damaged structural concrete elements (beams, columns)
- Repair of concrete cavities, due to poor casting and weak vibration
- Repairs of concrete precast elements

• High strength (class R4) • It contains pure quartz aggregates • Shrinkage compensating • Impermeable • Formulation rich in cement, which allows easy placing and finishing • Sprayable • Not flammable

FLUIDCRETE is a single component, high strength, shrinkage compensated, flowable mortar. Ideal for structural concrete repairs, precision grouting and anchoring of reinforcement. It is suitable for:

- Repairs of structural elements of concrete (beams, columns) using formworks
- Concrete jackets with dense reinforcement
- Precision grouting of machinery and steel columns
- Horizontal anchoring of steel reinforcing bars

•High strength (class R4) • It contains pure quartz aggregates • Shrinkage compensated • Impermeable • No bleeding or segregation • High flow (EN 13395-2) for full compaction even in areas with congested steelwork.

REPACRETE is a fiber-reinforced polymer modified, thixotropic, non-shrinking cement mortarenriched with quartz aggregates, with excellent adhesion to concrete. It does not contain corrosive components and is suitable for medium thickness structural repairs, in exterior or interior spaces. Classified as PCC R3 type concrete repair mortar, according to EN 1504-3 standard. Suitable for:

- Repair and restoration of worn and disorganized concrete elements on vertical and horizontal surfaces.
- Ideal for repairing failures on concrete surfaces (nests, pores, small imperfections in corners and edges).
- Restoration of damages resulting from bad defects, damage, etc.
- Covering restored reinforcing bars (in cases of oxidized and corroded reinforcement, cleaning and anti-corrosion coating with MSTEEL 44 should be previously done).

•Class R3 according to EN 1504-3 • Strong adhesion to the substrate • Fiber-reinforced • non-shrinking • High resistances• Excellent workability • Easy to handle and apply
•Provides abrasion resistance

CONTENT INFORMATION

This is an EPD of multiple products, based on an average product. **Cement-based Grout and Concrete Repair** has been selected as the average product. The composition of the product is expressed in mass per declared unit (kg/kg). The table below displays the content declaration for this average product.

CONTENT DECLARATION OF AN AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR EXPRESSED IN KG PER D.U. (KG/KG)				
PRODUCT COMPONENTS	**WEIGHT KG/KG**	**RANGE**	**POST-CONSUMER RECYCLED MATERIAL (%)**	**BIOGENIC MATERIAL, WEIGHT- % AND KG C/KG**
Portland Cement I 52.5 N	4.14E-01	3.00E-01 – 6.07E-01	0%	0
Calcium Carbonate	2.85E-01	1.33E-01 – 5.23E-01	0%	0
Calcium Oxide	2.81E-02	0.00E+00 – 3.50E-02	0%	0
Copolymer Vinyl Acetate And Ethylene	1.87E-03	0.00E+00 – 2.00E-02	0%	0
Silica Sand	2.37E-01	0.00E+00 – 3.30E-01	0%	0
Naphthalene Sulfonic Acid	6.21E-04	0.00E+00 – 1.00E-02	0%	0
Sulfur Dioxide	2.66E-02	0.00E+00 – 3.40E-02	0%	0
Special Additives	7.47E-03	1.83E-03 – 1.05E-02	0%	0
TOTAL	**1.00E+00**	**-**	**0%**	**0**
PACKAGING MATERIALS	**WEIGHT KG/KG**	**RANGE**	**WEIGHT (%) VERSUS THE PRODUCT**	**WEIGHT, BIOGENIC CARBON, KG C/KG**
Wooden-based Pallets	1.90E-02	1.67E-02 – 2.74E-02	1.90%	3.60E-04
Polyethylene LDPE Film	1.71E-04	3.00E-05 – 2.00E-04	0.02%	0
Carton Box	3.41E-03	6.00E-04	0.34%	1.53E-03
Paper Sacks	4.74E-03	0.00E+00 – 1.06E-02	0.47%	1.99E-03
Plastic Bags	1.81E-03	0.00E+00 – 1.06E-02	0.18%	0
TOTAL	**2.74E-02**	**-**	**2.74%**	**3.89E-03**

CARBON ELECTRICITY INTENSITY	
ENVIRONMENTAL EFFECTS	**GREEK MIX* - CO2 EMISSIONS (KGCO2/KWH)**
	0.642

**Residual Greek Mix: DAPEEP Report 2022 In accordance with section 1.4 of PCR 2019: 14 "Construction Products" version 1.3.1, it is required to disclose the climate impact (measured in kilograms of CO2 eq. per kilowatt-hour (kWh) using the GWP-GHG indicator) associated with the electricity acquisition during the manufacturing process in A3*

- No substances included in the Candidate List of Substances of Very High Concern for authorization under the REACH Regulations that exceed 0.1% of the total weight are present in the examined systems.

LCA INFORMATION

SYSTEM BOUNDARIES

This LCA study follows a “cradle-to-gate” approach with modules C1-C4 & module D.

DECLARED UNIT

The declared unit used in this EPD is **one (1) kilogram (kg) of an average Cement-based Grout and Concrete Repair Product.**

TIME REPRESENTATIVENESS

The data used for the analysis are based on one-year average production data, from August 2022 to July 2023.

GEOGRAPHICAL SCOPE

Global

DATABASES USED

Ecoinvent 3.8.1 & Professional 2021

SOFTWARE USED

LCA for experts (GaBi)

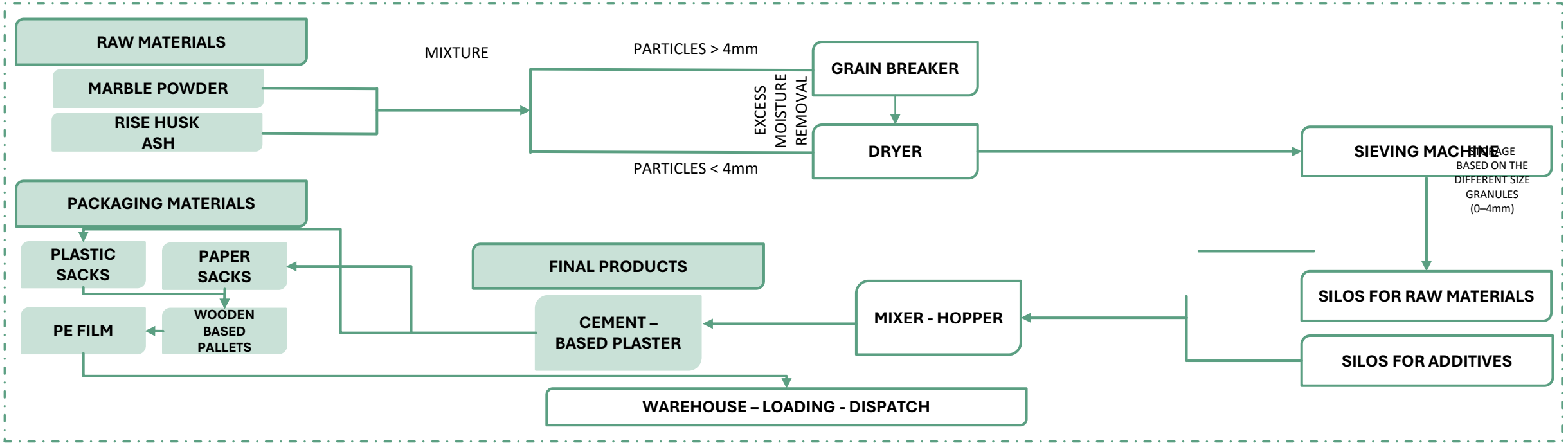
	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				RESOURCE RECOVERY STAGE
	Raw Material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse - Recovery - Recycling potential
MODULE	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
MODULES DECLARED	**X**	**X**	**X**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**X**	**X**	**X**	**X**	**X**
GEOGRAPHY	GLO	GLO	GR	-	-	-	-	-	-	-	-	-	EU-27	EU-27	EU-27	EU-27	EU-27
SHARE OF SPECIFIC DATA		>90%															
VARIATION – PRODUCTS		Variation – products **From -49.22% to 22.86%**															
VARIATION -SITES		0%															

*The variations above correspond to the differences in GWP-GHG indicator results in A1-A3 between an average cement-based Grout and Concrete Repair product and the FLUIDCRETE and the ARMOS 0-2MM, that correspond to the minimum and maximum results of the specific indicator, among the products under study.

DESCRIPTION OF EXAMINED MODULES

As depicted in the preceding diagram, the study encompasses specific Life Cycle stages: **Production, End-of-life,** and **Resource - Recovery**. Information modules that have been excluded (construction and use stages) are scenario-driven. The main aim of this Environmental Product Declaration (EPD) is to communicate the environmental factors associated with the real data that the company can manage during the production of cement-based grouts and concrete repair products.

THE PRIMARY PROCESSES INVOLVED IN THE PRODUCTION PROCESS ARE REPRESENTED IN THE BELOW FLOW-CHART:



PRODUCT STAGE

MODULES A1-A3

These aggregated modules (Modules A1-A3), comprehensively assess the entire lifecycle of raw materials and packaging components, encompassing their creation, transportation to Nordia's facilities, and the utilization of associated utilities such as electricity. To be more specific, Module A1 focuses on the manufacture of raw and packaging materials utilized in the production of cement-based grouts and concrete repair products, including items like Portland Cement I 52.5N, calcium carbonate, calcium oxide, polymer dispersions, as well as paper sacks, carton boxes, wooden-based pallets, and PE film for wrapping. Module A2 pertains to the transportation of these raw and packaging materials to Nordia's manufacturing plant. Lastly, Module A3 deals with the generation of imported electricity from the Greek grid and the utilization of propane for eliminating excess moisture.

DESCRIPTION OF EXAMINED MODULES

END-OF-LIFE STAGE

The end-of-life phase for the construction product initiates when it's either replaced, dismantled, or removed from the building or construction site, no longer serving any purpose. Alternatively, it can commence when the building itself reaches its end-of-life, depending on the chosen scenario for how the product's life ends. In this study, we take the perspective that the end-of-life stage for cement-based grouts and concrete repair products begins when the building is deconstructed or demolished, as these grouts and concrete repair products cannot be separated from the building's structure once installed.

In terms of the different end-of-life scenarios, we examine the emissions associated with disposing of 100% of cement-based grouts and concrete repair products waste during this phase. We opt for the most probable approach, which, in this case, is landfilling. Due to uncertainties regarding the specific disposal methods used, we've taken a practical approach and considered landfilling as the sole disposal option.

PROCESSES	KG/KG
Collection process specified by type	0kg collected separately 1kg collected with mixed construction waste
Recovery system specified by type	0kg for re-use
Disposal specified by type	0kg for recycling
Assumptions for scenario development (transportation)	0kg for energy recovery

MODULE C1

Module C1 focuses on calculating emissions associated with removing the product from the building during the deconstruction process. In this study, we have established a realistic scenario derived from literature research. The deconstruction of cement-based grouts and concrete repair products is assumed to be carried out using mechanical means, specifically employing a 100kW diesel excavator.

MODULE C2

Within this module, we examine the transport of disassembled cement-based grouts and concrete repair products to waste treatment facilities. We make certain assumptions regarding the average distance between construction sites and waste management facilities, as well as the modes of transportation involved.

MODULE C3

In this module, it is assumed the 100% of the cement grouts and concrete repair products waste will be landfilled and hence the environmental impact is considered equal to zero.

MODULE C4

This module takes into account the emissions linked to the disposal of all waste generated from cement-based grouts and concrete repair products. The most realist and plausible method, was adopted which in this instance, is landfilling.

Disclaimer: Considering that Module C is included in this EPD, is discouraged to use the results of modules A1-A3 without considering the results of module C.

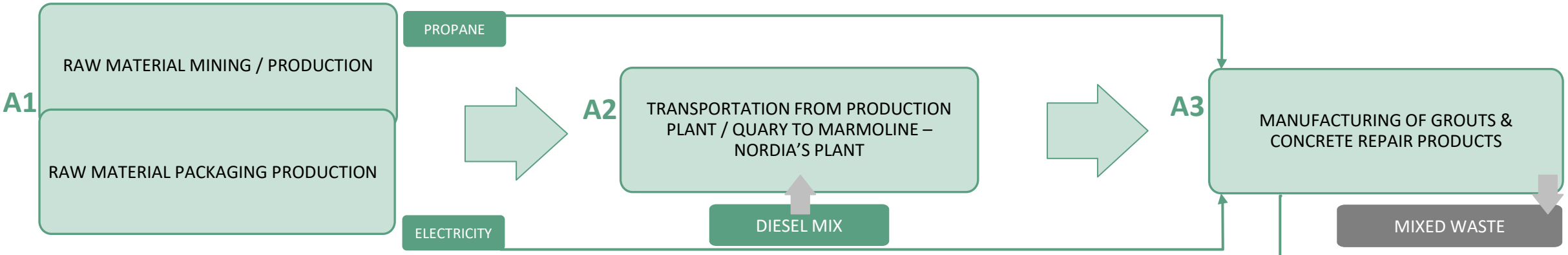
RESOURCE/ RECOVERY STAGE

MODULE D

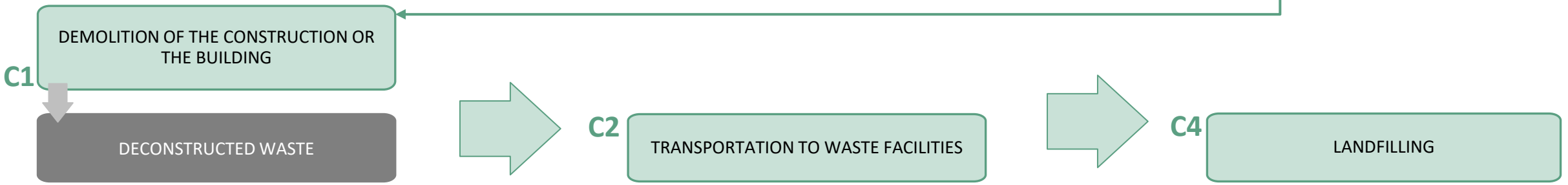
As outlined in the PCR for "Construction products," this module evaluates the environmental consequences of net flows involving reclaimed materials (those that are reused or recycled) or the energy output exiting modules A-C. Given that all deconstructed waste will be sent to a landfill without any recovery, reuse, or recycling processes, this module is considered to have zero impact.

SYSTEM DIAGRAM

PRODUCT STAGE
MODULES A1 – A3



END-OF-LIFE STAGE
MODULES C1, C2, C4



ADDITIONAL LCA INFORMATION

ASSUMPTIONS:

- Assumptions were employed when selecting the modes of transportation for road routes, taking into account factors such as technology, fuel type, and payload capacity. An average mode of transportation was chosen for each route to offer a reasonable approximation for all transported goods. It is assumed that a diesel-powered truck with Euro 6 emissions standards, a gross weight of 12-14 tons, and a payload capacity of 9.3 tons is used.
- An assumption was made regarding the timing and method used for disassembling cement-based grouts and concrete repair products. The end-of-life phase for these grouts and concrete repair products is set to align with the building's demolition. To achieve this, a deconstruction was carried out, using mechanical methods, specifically using a diesel-powered excavator with a 100kW power rating.
- Assumptions regarding the end-of-life of deconstructed cement-based grout and concrete repair product waste is used. More specifically, the most likely outcome is that all the broken-down waste will be sent to a landfill for disposal. This choice is supported by the fact that over 40% of waste made from cement in Greece is disposed of in this manner. Moreover, cement-based grouts and concrete repair products do not break down naturally or decompose, making them inappropriate for composting or other organic waste management methods. They are chemically stable, which reduces the risk of harmful substances seeping into the environment when they are securely stored in a landfill.
- Regarding the disposal of cement-based grouts and concrete repair products in landfills, a process referred to as "Treatment of limestone residue, inert material landfill" has been utilized. This approach is chosen due to the substantial presence of calcium carbonate in a significant portion of this waste category. Consequently, this specific database is deemed a fitting and precise portrayal of the waste material.
- An assumption regarding the proximity of waste treatment facilities to construction sites was made. Namely, it was assumed that the treatment facilities would be located within a distance of 100 kilometers from the construction sites.
- When annual production volumes were unavailable for the reference year, leading to the absence of packaging material consumption rates, a business-as-usual model was adopted to evaluate the potential environmental impacts of products, particularly exemplified by ARMOS 0-2MM, for which specific data were not accessible.
- Although drying and grain cracking processes do not take place on a regular basis in the production process, the LCA study takes them into account so as to assess the worst-case scenario

ALLOCATIONS:

- Regarding electricity consumption, 80% of the total volumes used, is attributed to the production of mortars.
- All propane consumption, constituting 100%, is exclusively allocated to mortar production, encompassing adhesives, floor screeds, plasters, grouts, and concrete repair products.
- The mass allocation method was utilized to assess manufacturing process waste, chosen for its reference to total facility waste volumes in the specified year.

CUT-OFFS:

The combined disregarded input flows for each module, such as A1-A3, C1-C4, and module D, should not exceed 5% of the total energy usage and mass. These guidelines were adhered to in order to assess the influence of including or excluding inventory flows. All key raw materials, components, and necessary energy inputs are accounted for within the system boundaries. The study incorporates data for basic flows to and from the product system, accounting for at least 99% of the stated environmental impacts. The only processes not considered in this study are:

- Production of certain primary flows, i.e., special chemical additives, which were determined to be considerably less than 1% of the declared environmental impacts.
- The handling of mixed municipal waste because the quantities generated are so minimal when compared to the declared unit volume, as to be considered inconsequential.
- Wooden-based pallets management is not included in this study since these pallets are intended for multiple uses.
- The manufacturing of silos designed for transportation purposes, as they fall under the classification of capital goods.

ENVIRONMENTAL PERFORMANCE INDICATORS

NORDIA S.A. – CEMENT-BASED GROUTS AND CONCRETE REPAIR PRODUCTS

MARMOLINE

POTENTIAL ENVIRONMENTAL IMPACTS / 1 KG OF AN AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCT								
CORE ENVIRONMENTAL IMPACT INDICATORS		UNIT	A1-A3	C1	C2	C3	C4	D
Global Warming Potential - total	GWP-total	kg CO_2 eq.	5.238E-01	6.460E-04	1.218E-02	0.000E+00	1.246E-02	0.000E+00
Global Warming Potential - fossil	GWP-fossil	kg CO_2 eq.	5.226E-01	6.410E-04	1.208E-02	0.000E+00	1.243E-02	0.000E+00
Global Warming Potential - biogenic[3]	GWP-biogenic	kg CO_2 eq.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Global Warming Potential - land use and land use change	GWP-luluc	kg CO_2 eq.	1.122E-03	5.057E-06	9.908E-05	0.000E+00	2.625E-05	0.000E+00
Global Warming Potential - GHG[1]	GWP-GHG	kg CO_2 eq.	5.238E-01	6.460E-04	1.218E-02	0.000E+00	1.246E-02	0.000E+00
Ozone Depletion Potential	ODP	kg CFC 11 eq.	1.198E-08	7.889E-20	1.546E-18	0.000E+00	3.597E-09	0.000E+00
Acidification Potential	AP	Mole of H+ eq.	2.934E-03	3.044E-06	1.174E-05	0.000E+00	1.108E-04	0.000E+00
Eutrophication Potential - freshwater	EP-freshwater	kg P eq.	6.565E-05	1.833E-09	3.592E-08	0.000E+00	9.337E-07	0.000E+00
Eutrophication Potential - marine	EP-marine	kg N eq.	1.711E-04	1.431E-06	3.691E-06	0.000E+00	4.286E-05	0.000E+00
Eutrophication Potential - terrestrial	EP-terrestrial	mol N eq.	3.774E-03	1.585E-05	4.454E-05	0.000E+00	4.679E-04	0.000E+00
Photochemical Oxidant Formation Potential	POCP	kg NMVOC eq.	1.132E-03	4.026E-06	1.014E-05	0.000E+00	1.324E-04	0.000E+00
Abiotic Depletion Potential - elements[2]	ADPe	kg Sb eq.	7.778E-07	4.701E-11	9.211E-10	0.000E+00	2.533E-08	0.000E+00
Abiotic Depletion Potential - fossil resources[2]	ADPf	MJ net calorific value	4.317E+00	8.220E-03	1.611E-01	0.000E+00	2.498E-01	0.000E+00
Water Deprivation Potential[2]	WDP	m^3 world eq. deprived	7.710E-02	5.362E-06	1.051E-04	0.000E+00	7.222E-03	0.000E+00

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero

[2] The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

[3] Actually, this indicator is negative due to an uptake of biogenic carbon in packaging materials. Considering that module A5 is not declared, the correlated emissions due to end-of-life of packaging, are balanced-out already in Module A1-A3, hence resulting in a total value of zero.

NORDIA

ENVIRONMENTAL PERFORMANCE INDICATORS

NORDIA S.A. – CEMENT-BASED GROUTS AND CONCRETE REPAIR PRODUCTS

POTENTIAL ENVIRONMENTAL IMPACTS/ 1 KG OF AN AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCT								
RESOURCE USE INDICATORS		UNIT	A1-A3	C1	C2	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ. net calorific value	1.774E+00	4.587E-04	8.988E-03	0.000E+00	2.724E-03	0.000E+00
Use of renewable primary energy resources used as raw materials	PERM	MJ. net calorific value	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total use of renewable primary energy resources	PERT	MJ. net calorific value	1.815E+00	4.587E-04	8.988E-03	0.000E+00	2.724E-03	0.000E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ. net calorific value	4.534E+00	8.231E-03	1.613E-01	0.000E+00	2.499E-01	0.000E+00
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ. net calorific value	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total use of non-renewable primary energy resources	PENRT	MJ. net calorific value	5.719E+00	8.231E-03	1.613E-01	0.000E+00	2.500E-01	0.000E+00
Use of secondary material	SM	kg	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Use of renewable secondary fuels	RSF	MJ. net calorific value	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Use of non-renewable secondary fuels	NRSF	MJ. net calorific value	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Use of net fresh water	FW	m^3	4.744E-03	5.251E-07	1.029E-05	0.000E+00	1.682E-04	0.000E+00

ENVIRONMENTAL PERFORMANCE INDICATORS

NORDIA S.A. – CEMENT-BASED GROUTS AND CONCRETE REPAIR PRODUCTS

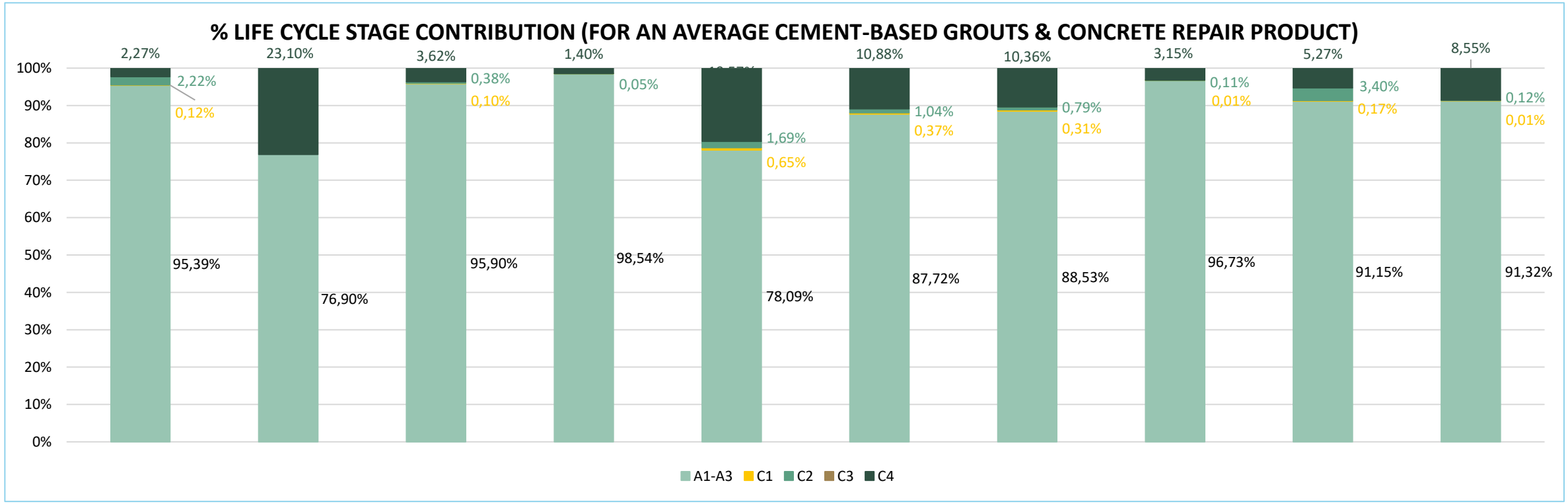
POTENTIAL ENVIRONMENTAL IMPACTS/ 1 KG OF AN AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCT								
WASTE INDICATORS		**UNIT**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	HWD	kg	4.551E-10	4.148E-13	8.126E-12	0.000E+00	0.000E+00	0.000E+00
Non-hazardous waste disposed	NHWD	kg	1.027E-02	1.223E-06	2.396E-05	0.000E+00	0.000E+00	0.000E+00
Radioactive waste disposed	RWD	kg	5.218E-05	9.956E-09	1.951E-07	0.000E+00	0.000E+00	0.000E+00
OUTPUT FLOWS		**UNIT**						
Components for re-use	CRU	kg	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Material for recycling	MFR	kg	1.260E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Materials for energy recovery	MER	kg	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Exported energy	EE	MJ	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS		**UNIT**						
Particulate matter emissions	PM	Disease incidence	5.279E-08	3.446E-11	7.031E-11	0.000E+00	6.333E-09	0.000E+00
Ionizing radiation human[4]	IRP	kBq U235 eq.	2.966E+00	1.425E-06	2.793E-05	0.000E+00	1.127E-03	0.000E+00
Eco-toxicity. Freshwater[2]	ETP-fw	CTUe	1.625E+01	5.941E-03	1.164E-01	0.000E+00	1.705E-01	0.000E+00
Human toxicity. Cancer effects[2]	HTP-c	CTUh	5.158E-09	1.198E-13	2.349E-12	0.000E+00	5.390E-12	0.000E+00
Human toxicity. Non-cancer effects[2]	HTP-nc	CTUh	3.155E-08	7.209E-12	1.215E-10	0.000E+00	1.239E-10	0.000E+00
Land use related impacts / Soil quality[2]	SQP	dimensionless	1.294E+01	2.823E-03	5.531E-02	0.000E+00	3.557E-01	0.000E+00

A complete list of the potential environmental impacts is available for the all cement-based Grouts and Concrete Repair Products and can be directly acquired from Nordia's personnel.

[2] The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.
[4] 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.

INTERPRETATION

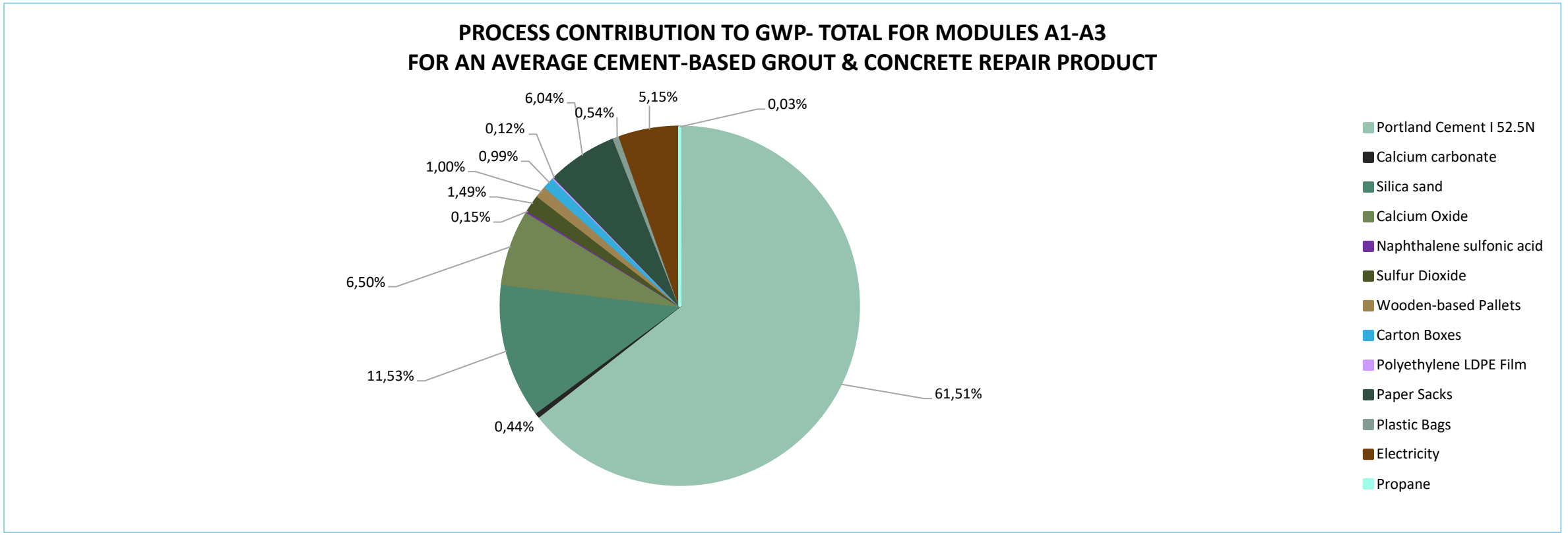
- The following diagram illustrates the respective contributions of the assessed modules (A1-A3 & C1-C4) to the fundamental environmental impact indicators. The evaluation of the outcomes took the form of a dominance analysis focused on these key environmental impacts. Evidently, the modules A1-A3 exert a predominant influence on the majority of the scrutinized impact categories
- Concerning the assessment of Global Warming Potential (GWP), it is observed that the most influential phases in the life cycle are modules A1-A3, which collectively contribute to almost 95% of the total impact. These modules encapsulate a significant portion of environmental considerations. Following these, Modules C1, C2, and C4 also play roles in GWP, albeit to a lesser extent, accounting for 0.12%, 2.22%, and 2.27%, respectively. This breakdown illustrates the hierarchy of contributions to GWP throughout the various phases of the product's life cycle.



Disclaimer:
The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

INTERPRETATION

- The majority of the total Global Warming Potential (GWP) is associated with the extraction and production of raw materials, with a notable focus on the manufacturing of Portland Cement I 52.5N. This significant influence is vividly depicted in the left-side chart of the presentation, where Portland Cement I 52.5N production alone accounts for over 61% the entire GWP-total. This emphasizes that the environmental impact, especially in terms of global warming potential, is greatly driven by the processes involved in obtaining and producing raw materials, and the production of Portland Cement I 52.5N plays a central role in this impact. The chart visually underscores the pivotal role of this particular aspect in the overall carbon footprint.



Disclaimer:
The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

ADDITIONAL ENVIRONMENTAL INFORMATION

% VARIATIONS OF INCLUDED PRODUCTS

ENVIRONMENTAL IMPACT INDICATORS

As per the PCR 2019:14 Construction Products version 1.3.1, when the products included exhibit a difference of over 10% concerning their declared environmental impact indicators, the specific variance for each impact indicator should be reported. The subsequent tables showcase total variances observed for all examined products, encompassing all the environmental impacts considered, compared to the potential environmental impacts of an average product.

% VARIATIONS FROM THE AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCT						
INDICATOR	**ARMOS 0-2MM**	**ARMOS 1-6MM**	**ARMOS 6-20MM**	**THIXOCRETE**	**FLUIDCRETE**	**REPACRETE**
Climate Change - Total	22.86%	-7.66%	-10.18%	0.98%	-49.22%	-27.29%
Climate Change - Fossil	23.04%	-7.54%	-10.11%	1.10%	-48.78%	-27.20%
Climate Change - Biogenic	NA	NA	NA	NA	NA	NA
Climate Change - Land Use and Land Use Change	-58.45%	-58.24%	-40.47%	-51.00%	-89.27%	-65.73%
Global Warming Potential - GWP-GHG	22.86%	-7.66%	-10.18%	0.98%	-49.22%	-27.29%
Ozone Depletion	70.81%	-6.35%	-5.21%	-22.73%	-77.45%	-37.35%
Acidification	-44.23%	-60.26%	-60.92%	10.46%	-47.41%	-6.95%
Eutrophication, fresh water	-11.92%	-53.24%	-37.89%	-65.58%	-90.76%	-75.08%
Eutrophication, marine	-8.73%	-27.38%	-23.24%	-32.55%	-83.68%	-44.18%
Eutrophication, terrestrial	20.95%	-7.40%	-6.34%	-11.47%	-69.59%	-33.14%
Photochemical Ozone Formation, human health	18.20%	-13.69%	-14.71%	-10.13%	-69.22%	-30.11%
Resource use, mineral and metals	43.28%	-33.12%	-51.88%	-17.99%	-78.06%	-30.28%
Resource use, fossils	26.45%	3.61%	-9.76%	-9.19%	-64.97%	-34.60%
Water Use	62.05%	22.16%	11.08%	-39.59%	-82.32%	-50.70%

The variations in impact indicators among products in this EPD, particularly when differences exceed 10%, were found to be linked with the concentration of cement within the respective product formulations. This association underscores the significance of cement content in influencing the observed differences in environmental impacts among the featured products.

ADDITIONAL ENVIRONMENTAL INFORMATION

% VARIATIONS OF INCLUDED PRODUCTS

USE OF RESOURCES

% VARIATIONS FROM THE AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCT						
INDICATOR	**ARMOS 0-2MM**	**ARMOS 1-6MM**	**ARMOS 6-20MM**	**THIXOCRETE**	**FLUIDCRETE**	**REPACRETE**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	-15.17%	-22.11%	-45.29%	-98.83%	-91.00%	-19.00%
Use of renewable primary energy resources used as raw materials	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	-17.08%	-23.86%	-69.68%	-98.86%	-90.79%	-20.82%
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	20.79%	-1.02%	-96.97%	-88.36%	-63.35%	-37.52%
Use of non-renewable primary energy resources used as raw materials	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	-2.42%	-19.98%	-97.47%	-90.61%	-54.66%	-49.52%
Use of secondary materials	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Use of renewable secondary fuels	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Use of non-renewable secondary fuels	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Use of net fresh water	54.65%	-51.42%	-97.42%	-71.54%	-56.52%	-78.47%

ADDITIONAL ENVIRONMENTAL INFORMATION

% VARIATIONS OF INCLUDED PRODUCTS

WASTE CATEGORIES

% VARIATIONS FROM THE AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR PRODUCT						
INDICATOR	**ARMOS 0-2MM**	**ARMOS 1-6MM**	**ARMOS 6-20MM**	**THIXOCRETE**	**FLUIDCRETE**	**REPACRETE**
Hazardous waste disposed	-59.06%	-61.89%	-42.49%	23.09%	16.40%	-21.08%
Non-hazardous waste disposed	-97.71%	-97.83%	-95.03%	38.05%	25.84%	-35.77%
Radioactive waste disposed	-90.74%	-89.73%	-84.86%	34.17%	22.88%	-30.53%

Regarding Output flows and considering that a mass balance approach was followed for waste produced from production processes, as well as the fact that all waste is considered to be landfilled, the variation for all output flows indicators for all of the examined products is set to 0%.

ADDITIONAL ENVIRONMENTAL INFORMATION

% VARIATIONS OF INCLUDED PRODUCTS

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

% VARIATIONS FROM THE AVERAGE CEMENT-BASED GROUT AND CONCRETE REPAIR						
INDICATOR	**ARMOS 0-2MM**	**ARMOS 1-6MM**	**ARMOS 6-20MM**	**THIXOCRETE**	**FLUIDCRETE**	**REPACRETE**
Particulate Matter emissions	-59.04%	-59.74%	-96.79%	-45.57%	3.15%	-49.22%
Ionizing radiation human	43.19%	8.13%	-45.31%	2.66%	21.95%	-28.09%
Eco-toxicity, freshwater	-79.14%	-87.43%	-98.29%	-91.23%	-27.04%	-92.96%
Human toxicity, cancer	-79.33%	-85.70%	-98.27%	-85.86%	-72.41%	-89.79%
Human toxicity, non-cancer effects	14.08%	-23.25%	-94.66%	-24.75%	8.54%	-46.89%
Land use related impacts / Soil quality	-55.83%	-63.77%	-89.79%	-62.23%	-88.05%	-68.13%

DIFFERENCES VERSUS PREVIOUS VERSIONS

2024-02-20 (Version 1.1)
Editorial Change: Addition of the Eco-platform logo

REFERENCES

- International EPD® System, PCR 2019:14 Construction Products, version 1.3.1
- EN 15804:2012+A2:2019/AC 2021 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- International EPD® System, General Program Instructions for the International EPD System, version 4.01
- ISO 14020:2000 - Environmental Labels and Declarations - General Principles
- ISO 14025:2006 - Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- ISO 14040:2006 - Environmental management - Life Cycle assessment - Principles and framework
- ISO 14044:2006 - Environmental management - Life Cycle assessment - Requirements and guidelines
- The International EPD® System - The International EPD System is a programme for type III environmental declarations, maintaining a system to verify and register EPDs as well as keeping a library of EPDs and PCRs in accordance with ISO 14025. www.environdec.com
- Sphera - GaBi Product Sustainability software - www.sphera.com
- Ecoinvent/ Ecoinvent Centre - www.Eco-invent.org
- Mavridou, Sofia. (2018). Construction and Demolition (C&D) Waste: Potential uses and current situation in Greece and Cyprus.