

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 & EN 15804:2012+A2:2019/AC:2021

Multiple-product EPD based on worst-case LCA results

BONDCRETE



EPD Program	Title	Details
International Climate Intelligence System 71-75 Shelton Street Covent Garden, London, WC2H 9JQ United Kingdom office@climateintell.com	Registration Number	ICIS-202605-135
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From raw mineral to site performance,
RAKfix controls every variable.



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OVERVIEW

This Environmental Product Declaration (EPD) presents verified, transparent environmental performance data for **RAKfix** Bondcrete products, manufactured by **RAKfix** at its facility in Ras Al Khaimah, United Arab Emirates, for the reporting period January 2025 to December 2025. The declaration covers multiple products within the **RAKfix** Bondcrete product group, as listed below:

- **RAKfix** 010 - Bonding key coat for general concrete surface.
- **RAKfix** 012 - Bonding key coat for densified concrete surface.
- **RAKfix** 014 - Bonding key coat for ultra-smooth and impermeable concrete surface.
- **RAKfix** 016 - Bonding key coat for non-absorbing surface of EPS/XPS.

In accordance with ICIS PCR 2026:18 v1.2.6 (EN 15804 + A2 aligned), the LCA results are calculated and reported using the worst-case product scenario within the declared product group. The declared unit for this assessment is 1 kg of **RAKfix** Bondcrete.

The life cycle assessment (LCA) follows the requirements of ISO 14025 and EN 15804:2012 + A2:2019/AC:2021, covering all relevant life cycle stages within the defined system boundary. This EPD supports architects, engineers, contractors, and sustainability consultants in making informed material selections by providing consistent, third-party-verified environmental information for use in green building certifications, embodied carbon assessments, and procurement decisions.



PRODUCT INFORMATION



Product Name

Bondcrete



Product Type

Cement-based dry-mix bonding and repair mortar



Declared Unit

1 kilogram



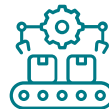
PCR & Version

ICIS PCR 2026:18 v1.2.6
(EN 15804 + A2 aligned)



Scope

Cradle-to-Gate with options (A1-A4, C1-D)



Production Route

Dry-mix blending



Recycled Content

Not intentionally added
(inherent recycled content only)



Electricity Mix

UAE grid mix from Ecoinvent 3.12 (cut-off). Natural Gas (69.32%), Hard Coal (18.70%), Nuclear (11.63%) and others.



LCA Tool and Database

Air.e.LCA v3.21.0.7 and Ecoinvent v3.12 (Cut-Off)



Geographical Scope

United Arab Emirates



PRODUCT INFORMATION



Verification

International Climate Intelligence System
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Product Group Classification

UN CPC code: 37540 –
Non-refractory mortars and concretes

Environmental Performance Summary (A1-A3)

Indicator	Result	Unit
Climate change (GWP) - total	4.29E-01	Kg CO ₂ e
Climate change (GWP) - fossil	4.28E-01	Kg CO ₂ e
Ozone Depletion (ODP)	2.57E-09	Kg CFC-11e
Abiotic depletion of fossil resources	2.23E+00	MJ

Hotspot Summary

Process	Share of Total GWP (%)
Raw Material Supply (A1)	88.88
Raw Material Transportation (A2)	0.81
Manufacturing (A3)	3.41
Remaining Modules (A4, C1-C4)	6.90



PRODUCT INFORMATION

Where This Adds Value

Scheme / Area	Relevance to Bondcrete
LEED v4.1 / v5 (USGBC) – MR Credit: EPDs	The Type III EPD supports MR credits for Environmental Product Declarations and contributes to whole-building life cycle assessment (LCA), enabling embodied carbon evaluation of cementitious bonding and repair mortars in UAE-based projects.
BREEAM International – Mat 01 / Mat 02	Provides third-party verified environmental data aligned with EN 15804, supporting Mat 01 life cycle impacts and Mat 02 responsible sourcing credits for projects delivered in the UAE under BREEAM International schemes.
Estidama Pearl Rating System (Abu Dhabi) – SM Credit: Material Selection	Supports compliance with Estidama material transparency and LCA-based evaluation requirements, enabling informed selection of construction materials for Pearl-rated developments in Abu Dhabi.
Dubai Green Building Regulations (DGBR) – Materials & Resources Section	Supports material documentation and environmental performance reporting requirements under DGBR, facilitating approval of cementitious repair and bonding materials in Dubai construction projects.
Infrastructure & Building Projects (UAE – DM, ADM, RAK Municipality)	Provides project-specific environmental data for bonding and repair mortars used in concrete and masonry systems, supporting sustainable design, specification, and approval processes across UAE municipal authorities.
Procurement Transparency (UAE Contractors & Consultants)	Supports contractor and consultant requirements for verified environmental documentation in material submittals, technical approvals, and sustainability reporting across commercial and infrastructure projects in the UAE.

PRODUCT INFORMATION

UAE Net Zero 2050 &
National Climate
Reporting

Provides product-specific environmental data to support embodied carbon calculations and reduction strategies, enabling alignment with UAE Net Zero 2050 targets and national greenhouse gas reporting frameworks.



ABOUT RAKfix

Founded in 2006, **RAKfix** is a UAE-based manufacturer specialising in cementitious dry-mix solutions for building and infrastructure applications and has established a strong presence across the Emirates. The company supplies a range of bonding, repair, and surface preparation products, supporting quality construction practices through consistent factory-controlled production and reliable on-site performance across diverse project conditions.

RAKfix dry-mix mortars are widely used across building and infrastructure projects in the United Arab Emirates, including residential, commercial, and high-rise developments. Project outcomes include consistent material quality, reliable performance aligned with construction requirements, and efficient application using mechanised systems across diverse site conditions, supporting quality construction practices within conventional building systems. Improved surface quality and finish through controlled material consistency and application.

- Consistent material quality through controlled factory production.
- Reliable performance aligned with construction and engineering requirements.
- Compatibility with mechanised application systems for efficient site execution.
- Application across diverse environments including residential and commercial

projects.

- Successful use across varying project scales and construction conditions.

RAKfix products are widely recognised within the UAE construction sector for their consistent performance and reliability, supporting adoption across major building and infrastructure projects. The brand is associated with quality-focused construction practices and is routinely specified by contractors and consultants for dry-mix mortar applications.

Key recognition aspects include:

- Established presence within the UAE construction industry.
- Acceptance across contractor and consultant networks.
- Proven performance in multiple construction applications.
- Industry confidence supporting continued project adoption.

PRODUCT DESCRIPTION

RAKfix Bondcrete products are cement-based dry-mix bonding and repair mortars formulated to improve adhesion, surface uniformity, and substrate performance in concrete and masonry applications. The product group includes the following products:

- **RAKfix** 010 - Bonding key coat for general concrete surface.
- **RAKfix** 012 - Bonding key coat for densified concrete surface.
- **RAKfix** 014 - Bonding key coat for ultra-smooth and impermeable concrete surface.
- **RAKfix** 016 - Bonding key coat for non-absorbing surface of EPS/XPS.

These products are applied as thin bonded layers over prepared concrete and masonry substrates and are compatible with manual application and mechanised systems. The formulations consist primarily of limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and other functional components that influence workability, bonding strength, surface uniformity, and durability. **RAKfix** Bondcrete products are designed for applications where surface preparation, repair, and bonding performance are critical to overall system integrity, supporting the development of prepared substrates that enhance adhesion of subsequent layers while maintaining structural compatibility. Typical applications include plaster bonding, patch repairs, surface levelling, and concrete preparation works across residential, commercial, and infrastructure projects. The products are supplied in 25 kg and 50 kg bags and mixed with water prior to application, enabling consistent performance across large-scale and site-based construction activities.

Sectors & Corresponding Uses

Sector	Application / Use Case
Residential Construction	Use in plaster bonding, surface preparation, and repair works to improve adhesion and finish quality
Commercial Buildings	Application in surface levelling, patch repairs, and bonding layers for uniform substrates and reliable performance
Infrastructure Projects	Use in concrete repair, surface preparation, and bonding applications for structural and non-structural elements
High-Rise Developments	Application in mechanised plastering and bonding systems to support efficient execution and consistent quality
Refurbishment & Maintenance Projects	Use in repair, patching, and substrate preparation to restore surface integrity and performance

PRODUCT DESCRIPTION

Technical Specifications

Parameter	Details / Specification
Form	Powder (cement-based dry-mix mortar)
Mixing Method	Mixed with water at site to form slurry or mortar prior to application
Application Thickness	Typically applied as thin bonding or repair layer (varies by product)
Workability	Designed for good spreadability and ease of application (manual or machine)
Bond Strength	Provides strong adhesion to concrete, blockwork, and plaster substrates
Application Method	Manual application or mechanised systems (e.g., plastering machines)
Surface Function	Improves adhesion, surface uniformity, and substrate preparation for subsequent layers
Standards Compliance	Designed in accordance with relevant BS, ASTM, and DIN specifications
Storage Conditions	Store in dry conditions in original sealed packaging, protected from moisture
Shelf Life	Typically 12 months under recommended storage conditions
Packaging	Supplied in 25 kg and 50 kg bags



MANUFACTURING DETAILS

The production of **RAKfix** Bondcrete products is based on a controlled dry-mix manufacturing process using cementitious and mineral-based raw materials. The process begins with raw material handling, where key inputs such as limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and other functional components are received, inspected, and verified for quality and conformity with internal specifications. Where required, coarse mineral materials undergo crushing to achieve the desired particle size, followed by screening to ensure a consistent and controlled particle size distribution suitable for dry-mix applications.

Processed materials are then transferred to dedicated storage silos or bins under dry, moisture-controlled conditions to maintain stability prior to production. During manufacturing, each raw material is precisely measured through automated dosing systems in accordance with the defined formulation and transferred to high-efficiency mixers. Controlled mixing is carried out to produce a homogeneous dry powder with uniform distribution of all constituents.

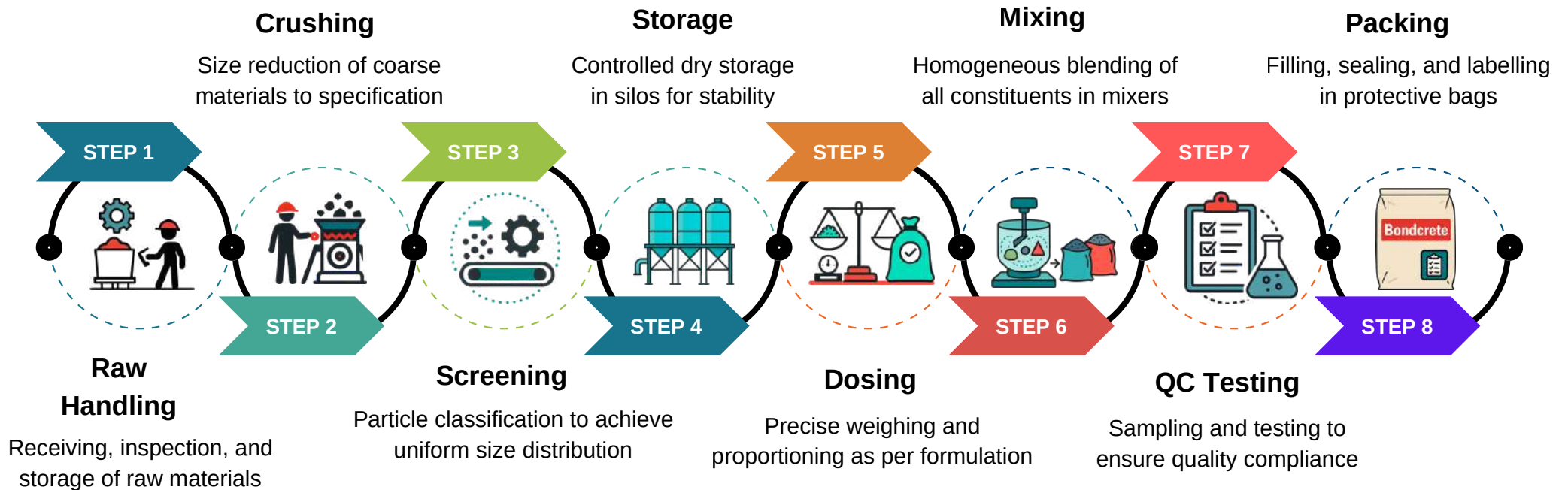
Representative samples are collected during and after mixing for quality control (QC testing) to verify consistency, workability, and compliance with product specifications. Following successful verification, the finished product is transferred to the packing stage, where it is filled into moisture-resistant bags (25 kg and 50 kg), sealed, labelled, and prepared for dispatch. The manufacturing process consists primarily of physical operations, with no intended chemical reactions occurring during production.

For a visual representation of the full manufacturing workflow, refer to the illustrated flowchart on the next page. A screenshot of the process flow for a representative Bondcrete product, **RAKfix** 014, as modelled in the LCA software, is provided on the following page.



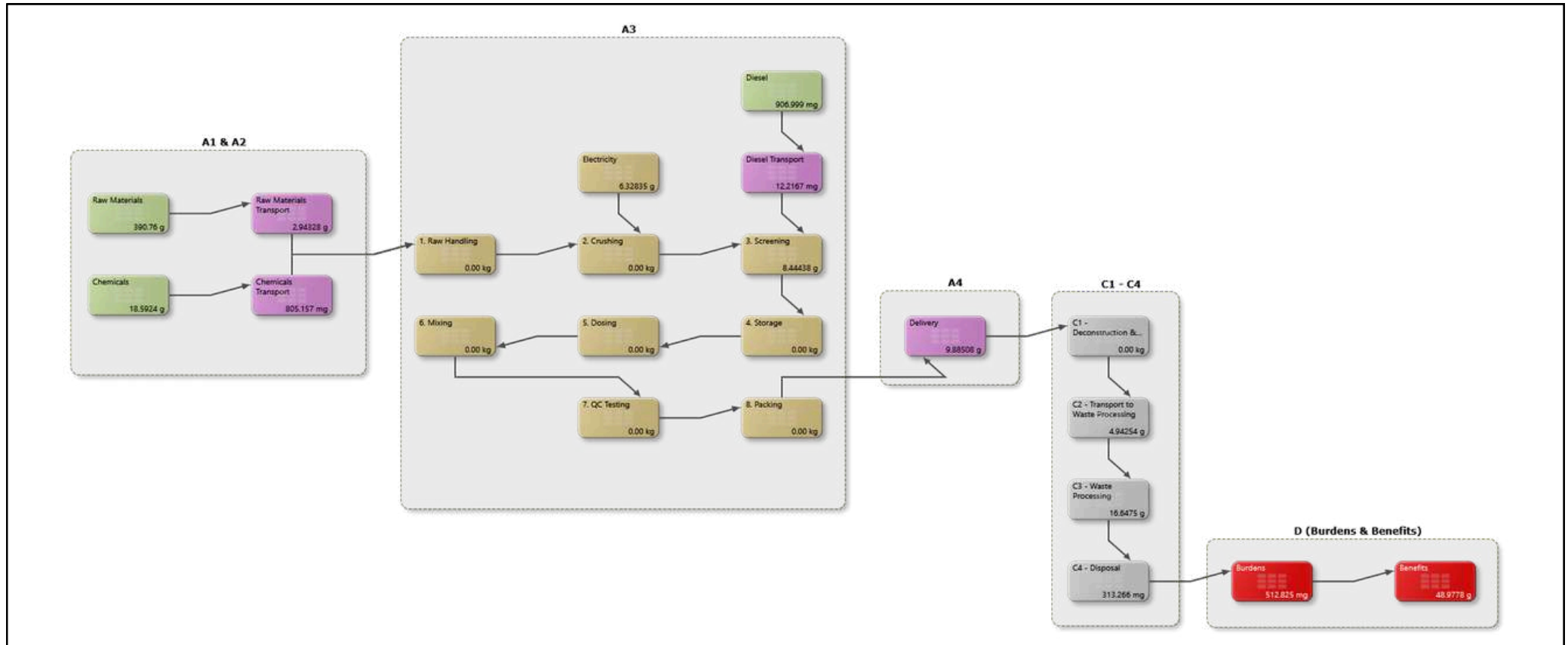
MANUFACTURING DETAILS

Schematic overview of RAKfix Bondcrete manufacturing process



MANUFACTURING DETAILS

Screenshot of RAKfix 014 LCA model from LCA software



CONTENT DECLARATION

The content declaration provides a transparent breakdown of all raw materials used in the formulation of **RAKfix** Bondcrete products (**RAKfix** 010, **RAKfix** 012, **RAKfix** 014, and **RAKfix** 016), expressed per 1 kg of product. The formulation is primarily composed of limestone fillers and Ordinary Portland Cement (OPC) supported by polymer powders, cellulose-based additives, and small quantities of other functional components that influence workability, bonding performance, durability, and stability. The total of all listed components equals 1 kg, matching the declared unit and ensuring complete material accounting in line with EN 15804 and ISO 14025 requirements.

Component	Weight (kg/Declared unit)	Post-consumer recycled (%)	Pre-consumer recycled (%)	Biogenic Content (%)	Biogenic Carbon (kg C/DU)
Limestone	0.59	0	0	0	0
OPC	0.40	0	0	0	0
Polymer Powder	0.005	0	0	0	0
Cellulose Powder	0.0005	0	0	0	0
Total	1	0	0	0	0

Substances of Very High Concern (SVHC)

According to the requirements of the ECHA Candidate List, **RAKfix** Bondcrete products (**RAKfix** 010, **RAKfix** 012, **RAKfix** 014, and **RAKfix** 016) contain no substances of very high concern (SVHCs) above the 0.1% (w/w) threshold in the final product or its ancillary materials.

All raw materials used in the formulation—primarily limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and minor functional components—were reviewed against the latest published SVHC list at the time of reporting. Based on manufacturer declarations and available safety data, no SVHCs are present above the applicable threshold.

Packaging Material Declaration

Packaging materials used for **RAKfix** Bondcrete products include wooden pallets and paper bags. These materials serve distinct functions within the product supply chain—wooden pallets provide stability during handling and transport, while paper bags securely contain the dry-mix product and facilitate safe delivery to site. All packaging components are included in the life cycle assessment because they contribute to upstream manufacturing impacts and generate recoverable material streams at end-of-life.

CONTENT DECLARATION

Packaging Material	Biogenic Content (%)	Biogenic Carbon Fraction (kg C/kg material)	Notes & References
Wooden Pallet	~100% biogenic (solid wood)	0.50 kg C per kg wood (approx. 50% of dry mass is carbon)	Wood carbon fraction widely documented in forestry & IPCC (2006) guidelines — wood contains 50% carbon by dry weight
Paper Bags	~100% biogenic (paper fibre)	0.44 kg C per kg paper (44% carbon content)	Paper/pulp industry data and IPCC default values for lignocellulosic biomass

Wood and paper bags contain significant biogenic carbon because they originate from biomass. These biogenic fractions are reported for transparency and to reflect the renewable carbon temporarily stored in packaging materials. Their treatment in the LCA model follows EN 15804+A2 guidance, with flows presented in the Packaging Composition and Biogenic Carbon table below.

Packaging Material	Weight (kg/Declared Unit)	Share of Packaging (%)	Biogenic Carbon (kg C/DU)	End-of-Life Handling
Wooden Pallet	6.22E-03	67.47	3.11E-03	Reuse / Recycle / Energy Recovery
Paper Bags	3.00E-03	32.53	1.32E-03	Recycle
Total	9.22E-03	100	4.43E-03	-

Note - Biogenic content in packaging materials **exceed the 5% threshold** of the total packaging weight as stated in **ICIS PCR 2026:18**. Hence, these biogenic emissions are added in **module A3 and balanced out in module A5**.



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Declared Unit

The declared unit for this EPD is 1 kg of **RAKfix** Bondcrete products (**RAKfix** 010, **RAKfix** 012, **RAKfix** 014, and **RAKfix** 016) at the factory gate. All material inputs, energy use, emissions, transportation, packaging, and end-of-life modelling are quantified relative to this unit. This ensures consistent comparison across life cycle stages and aligns with EN 15804+A2 requirements for construction products. No functional performance is assigned to the products in this declaration, as the EPD is based on a declared unit rather than a functional unit.

Temporal, Geographical and Technological Representativeness

Temporal Representativeness: Primary data for **RAKfix** Bondcrete reflects the reporting period January 2025 to December 2025, in line with EN 15804+A2 requirements that primary manufacturing data must be no older than five years. All on-site information—including raw material consumption, energy use, water use, and waste generation—represents current operational conditions at the Ras Al Khaimah facility during the defined reporting year. Background data used in the study are consistent with the temporal validity provided in their respective datasets to ensure alignment with the modelling year.

Geographical Representativeness: The LCA model for **RAKfix** Bondcrete reflects the actual manufacturing and supply conditions of **RAKfix's** Ras Al Khaimah facility in the United Arab Emirates, where all primary data was collected. The study represents production and operations within UAE, with UAE-specific or GCC-specific conditions applied wherever available — particularly for raw material sourcing patterns, electricity grid characteristics, water production, and end-of-life treatment routes.

Where UAE-specific datasets or regional factors were not available, GCC-appropriate or globally representative datasets were used. All transport distances, energy consumption figures, and end-of-life scenarios are based on realistic practices in the UAE, ensuring geographical relevance of the final results.

Technological Representativeness: The manufacturing process modelled for **RAKfix** Bondcrete accurately reflects the actual production technology used at the Ras Al Khaimah facility. The product is produced through controlled batching and physical dry mixing of cement, limestone fillers, polymer powders, cellulose-based additives, and other functional components using industrial dosing and mixing equipment, followed by quality control and packaging operations. No intended chemical reactions, thermal processing, or high-temperature treatment occur during manufacturing. The technological assumptions used in the LCA are therefore representative of

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real operations at the plant, ensuring that the results reflect site-specific production conditions.

LCA Software & Database

The life cycle model for **RAKfix** Bondcrete was developed using Air.e.LCA v3.21.0.7, with all background inventory data sourced from Ecoinvent v3.12 (Allocation, cut-off by classification). The software was used to structure process flows, assign datasets, calculate environmental indicators, and perform all module-by-module inventory tracking. The database provides consistent, peer-reviewed life cycle inventories for raw materials, energy supply, transportation, and waste management processes. All datasets selected reflect technologies and supply chains relevant to the product and regional context, ensuring reliable integration of foreground data with established international life cycle inventories.

System Boundary

This EPD covers all product stages from “cradle to gate with options”, i.e. this LCA covers Production stage A1-A3, Transportation A4, End-of-life stages C1-C4 and Resource recovery stage D according to EN 15804:2012 + A2:2019 / AC:2021.

The procedures that are not controlled by the company, but are included in this environmental study, are:

- The extraction and production of fuels and electricity.

All related direct and indirect environmental impacts related to these elements have been calculated and were included in the LCA and this EPD. Personnel-related processes, such as transportation of employees to and from work is excluded. Also, the production and end-of-life processes of infrastructure or capital goods used in the product system are excluded.

Module A1 - Raw Material Supply

Module A1 encompasses all upstream processes related to the sourcing and preparation of raw materials used in the manufacture of **RAKfix** Bondcrete. The primary constituents—limestone fillers and Ordinary Portland Cement (OPC)—are sourced locally from Ras Al Khaimah within the United Arab Emirates, ensuring consistent quality and suitability for cement-based dry-mix formulations. Additional components such as cellulose-based additives are sourced from Germany, while polymer powders are procured from Germany and China in accordance with technical specifications and availability. Packaging materials including wooden pallets and paper bags are sourced within Dubai. All upstream activities such as raw material extraction, intermediate processing, and packaging of inputs are included within this module.



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Module A2 - Raw Material Transportation

Module A2 covers the transportation of all raw and packaging materials to the **RAKfix** facility in Ras Al Khaimah, United Arab Emirates. The primary raw materials—limestone fillers and Ordinary Portland Cement (OPC)—are sourced locally within Ras Al Khaimah and transported to the facility using >32-ton Euro 6 lorries, representative of bulk material transport within the region. Packaging materials including wooden pallets and paper bags are sourced from Dubai and delivered via similar road transport. Additional components such as cellulose-based additives and polymer powders are imported from Germany and China and transported via sea freight in containerised shipments to the UAE, followed by road transport to the manufacturing facility.

Environmental impacts in this module arise from fuel consumption associated with sea freight transport and domestic heavy-duty road transport. Transport distances, load factors, and logistics modelling reflect realistic supply chain conditions for both imported and locally sourced materials, ensuring representative accounting of inbound transport to the Ras Al Khaimah facility.

Module A3 - Manufacturing

Manufacturing impacts cover all processes required to convert raw materials into finished **RAKfix** Bondcrete at the Ras Al Khaimah production facility. Production follows a controlled dry-mix process comprising sequential stages: Raw Handling, Crushing, Screening, Storage, Dosing, Mixing, Quality Control, and Packing. These stages ensure accurate proportioning of cementitious and mineral constituents, homogeneous blending, and consistent product quality to achieve the specified bonding performance and durability characteristics required for construction applications.

Environmental loads in this module include electricity consumption for dosing, mixing, and packing operations; diesel use for internal material handling via forklifts and mobile equipment; and minor emissions associated with material transfer and handling. Additional impacts include negligible solid waste generation from packaging and routine operational activities, with waste streams managed through recycling practices. All direct emissions from electricity use, fuel combustion, on-site equipment operation, and material handling are included within the A3 system boundary.

Module A4 - Delivery

Module A4 accounts for the transportation of finished **RAKfix** Bondcrete from the Ras Al Khaimah manufacturing facility to customer locations. Since the products are supplied exclusively within the United Arab Emirates, all outbound transport occurs via road freight. Deliveries are modelled using Euro 6, >32-ton trucks consistent with ecoinvent v3.12 cut-off system model assumptions, reflecting typical heavy-duty vehicles used for bulk construction materials in the region.

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As a dry powder packaged in bags and palletised for shipment, the products are transported as consolidated loads with high capacity utilisation. Transport distances are based on representative average delivery routes within the UAE, covering distribution to construction sites, contractors, and infrastructure projects. Environmental impacts in this module include diesel consumption, tailpipe emissions, and load-dependent fuel use associated with outbound transport.

Scenario details	Description
Vehicle used for transport	Euro 6, >32 ton truck
Vehicle capacity	>32 tons
Fuel type and consumption	Diesel, 0.38 liters per km
Capacity utilization	100% as assumed in Ecoinvent v3.12
Bulk transportation	Mass of the transported product



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C1 - Deconstruction and Demolition

Module C1 covers the impacts associated with the deconstruction and demolition stage at end-of-life. **RAKfix** Bondcrete (**RAKfix** 010, **RAKfix** 012, **RAKfix** 014, and **RAKfix** 016) are cement-based products applied as thin bonding or coating layers and become fully adhered to concrete or masonry substrates during use. Once hardened, these products are not separable from the host structure and do not exist as distinct components.

At the end of the service life, demolition activities are carried out using standard mechanical methods applied to the structural element (e.g., breaking or crushing of concrete). The presence of **RAKfix** Bondcrete does not influence the demolition process in terms of equipment, energy demand, or operational requirements.

Consequently, no additional environmental burdens can be attributed specifically to these products during deconstruction. The impacts associated with Module C1 are therefore considered negligible and are not assigned to the declared unit.

C2 - Transport to Waste Processing

Module C2 covers the transport of end-of-life materials from the demolition site to waste management facilities. Following demolition, **RAKfix** Bondcrete become part of mixed mineral construction and demolition (C&D) waste generated from the breakage of concrete or masonry elements.

As the products are manufactured and used exclusively within the United Arab Emirates, the resulting demolition waste is managed entirely within the national waste management system. The UAE has a well-developed network of C&D recycling facilities operated by entities such as Dubai Municipality, Tadweer (Abu Dhabi), and BEEAH (Sharjah), where mineral construction waste is processed into recycled aggregates. Across these systems, diversion rates for concrete and masonry waste typically range between 90% and 97%, supported by regulatory requirements and strong demand for recycled aggregate in infrastructure and civil works.

These recovery levels are consistent with those observed in countries with advanced C&D waste management systems—such as the Netherlands, Denmark, Belgium, Japan, and Singapore—where recycling rates commonly reach 90–99%. These international values are provided for contextual benchmarking only; the modelling approach is based solely on UAE-specific practices. Reflecting the established recycling performance in the UAE, it is assumed that 95% of the mixed demolition waste containing **RAKfix** products is transported to C&D recycling facilities, while the

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remaining 5% is transported to inert landfill sites due to contamination, sorting limitations, or non-recoverable fractions. A one-way transport distance of 50 km is applied for both routes, representing typical distances between demolition sites and authorised waste management facilities within the UAE.

Transport is modelled using heavy-duty diesel trucks (>32-tonne capacity, Euro 6 equivalent), consistent with standard life cycle inventory datasets for bulk mineral waste transport. Load utilisation and fuel consumption reflect typical operational conditions for construction waste logistics in the region.

Module C2 therefore accounts exclusively for the environmental impacts associated with fuel consumption and emissions arising from the transportation of mixed mineral demolition waste to recycling and disposal facilities.

Type	Capacity utilization	Type of vehicle	Average distance
Truck	92%	Euro 6, >32 ton truck	50 kms

C3 - Waste Processing

Module C3 covers the processing of construction and demolition (C&D) waste before final disposal or recovery. At end-of-life, **RAKfix** Bondcrete remain adhered to the host concrete or masonry substrate and therefore enter the waste stream as part of mixed mineral demolition rubble rather than as separately recoverable products.

Within the United Arab Emirates, C&D waste is processed through established recycling infrastructure. In Sharjah, BEEAH's C&D recycling facility processes around 500,000 tonnes of construction and demolition waste annually into certified recyclable products, while in Abu Dhabi, Tadweer operates dedicated C&D materials recovery and crushing facilities that divert demolition waste from landfill and recover reusable materials for reintegration into infrastructure applications. In parallel, the UAE's Ministry of Climate Change and Environment has issued national requirements supporting the use of recycled aggregates from construction and demolition waste in roads and other infrastructure works, subject to quality verification.

In practice, the recycling route for this waste stream consists of mechanical treatment steps such as acceptance, sorting, crushing, and screening to produce recycled aggregate and fines suitable for further use. The hardened **RAKfix** Bondcrete products follow this same mineral processing

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route and do not require any separate handling, treatment, or recovery operation of their own. This is because their contribution is minor relative to the host concrete or masonry waste stream and does not alter the configuration or efficiency of the recycling process. The description of crushing-based recovery is consistent with the UAE facilities cited above and with the country's regulatory framework promoting recycled aggregate use.

Consistent with the scenario defined in Module C2, 95% of the mixed demolition waste containing **RAKfix** products is assumed to enter recycling and waste-processing operations, while the remaining 5% bypasses recovery and proceeds directly to disposal in Module C4. Module C3 therefore includes the environmental burdens associated with the mechanical processing of the recyclable mineral fraction of the demolition waste.

C4 - Disposal

Module C4 covers the final disposal of materials that are not recovered through recycling processes. For **RAKfix** Bondcrete, this corresponds to the fraction of mixed construction and demolition (C&D) waste that is not suitable for recycling due to contamination, segregation limitations, or material quality constraints.

It is assumed that 5% of the mixed mineral demolition waste containing **RAKfix** Bondcrete is directed to inert landfill facilities within the United Arab Emirates. This reflects typical outcomes in C&D waste management systems where a small residual fraction cannot be recovered.

The disposed material consists primarily of inert mineral waste derived from crushed concrete, mortar, and masonry. Once cured, **RAKfix** Bondcrete behave similarly to these materials and exhibit negligible biodegradability, no potential for landfill gas generation, and very low chemical reactivity.

Inert landfill operations in the UAE involve standard activities such as placement, spreading, compaction, and dust control. As the material is non-hazardous and non-reactive, environmental impacts associated with disposal are limited to operational activities at the landfill site.

Module C4 therefore includes only the environmental burdens associated with the handling and disposal of the non-recyclable fraction of mineral construction waste, with no additional emissions attributable specifically to the **RAKfix** Bondcrete.



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D - Reuse, Recovery & Recycling Potential

Module D reports the net environmental burdens and benefits associated with materials leaving the system boundary at end-of-life. These outcomes reflect the substitution of primary materials with secondary materials recovered through recycling, reuse, or energy recovery routes. For **RAKfix** Bondcrete, benefits arise from the recovery of the mineral fraction of demolition waste as well as from the recovery of associated packaging materials.

At end-of-life, 95% of the mixed mineral demolition waste containing **RAKfix** Bondcrete is assumed to be processed at construction and demolition (C&D) recycling facilities, where it is converted into recycled aggregates that substitute natural aggregates on a mass-equivalent (1:1) basis. In the United Arab Emirates, facilities operated by entities such as BEEAH (Sharjah) and Tadweer (Abu Dhabi) process concrete and masonry waste into reusable aggregates for infrastructure applications. Reported recovery rates for mineral C&D waste in the UAE typically exceed 90–95%, supported by regulatory frameworks and demand for recycled materials.

These recovery levels are consistent with international best practices observed in countries with advanced C&D recycling systems—such as the Netherlands, Denmark, Belgium, Japan, and Singapore—where recycling rates for concrete and masonry waste commonly reach 90–99%. These benchmarks are provided for contextual reference only, while the modelling is based on UAE-specific practices.

Packaging materials are also considered under end-of-life recovery scenarios. Wooden pallets are assumed to achieve a 95% recovery rate, reflecting established industry practices of reuse, repair, and recycling. Studies on pallet lifecycle management, including work by the Virginia Tech and USDA Forest Service, report that approximately 95% of wooden pallets are diverted from landfill through reuse, repair, recycling, or energy recovery routes, supporting this assumption.

Paper-based packaging (multi-wall kraft cement bags) is assumed to be collected and directed to recycling or energy recovery under controlled waste management conditions. According to industry guidance from organisations such as the American Forest & Paper Association (AF&PA) and global paper recycling statistics, paper and paperboard recovery rates commonly exceed 65–70%, with higher recovery achievable in industrial or segregated waste streams.

Module D therefore captures the net environmental burdens and benefits associated with these recovery routes. Recycled mineral aggregates displace primary crushed aggregates; recovered wooden pallets offset virgin wood production or fossil fuel use when directed to energy recovery;

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and recovered paper materials substitute virgin paper fibre or contribute to energy generation.

The reported results in Module D represent the combined effect of the environmental burdens of recycling processes and the avoided impacts associated with the substitution of primary materials. These benefits arise from the broader waste management system and not from the **RAKfix** Bondcrete themselves, which are present as a minor fraction within the overall demolition waste stream.

Process	Unit (kilogram)
Collection process specified by type	
RAKfix Bondcrete in concrete collected as mixed mineral C&D waste	1
Recovery system specified by type	
Mineral demolition rubble sent for reuse / recycling as aggregate	0.95 (95%)
Mineral demolition rubble sent for energy recovery	Not applicable
Disposal specified by type	
Mineral demolition rubble sent to inert landfill	0.05 (5%)
Transportation assumptions	
Transport to recycling and landfill sites	50 km transport by Euro 6, >32 ton truck



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System Boundaries Illustration

	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	Deconstruction & 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	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	UAE	UAE	UAE	UAE	-	-	-	-	-	-	-	-	UAE	UAE	UAE	UAE	UAE
Share of specific data	GWP > 90%				-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X - Included, ND - Modules not declared.

*Module A5 is included to balance out biogenic emissions from packaging.



LCA KNOWLEDGE

Cut-Off Rules

All relevant material and energy flows contributing to the manufacture of **RAKfix** Bondcrete have been included in the LCA model. More than 99% of the total mass, energy use, and environmental relevance is captured. Negligible flows—those that do not influence the overall results—are excluded.

The Polluter Pays Principle and the Modularity Principle are applied to ensure that impacts are assigned to the processes where they occur and that each life cycle stage is reported independently. No known data gaps or exclusions are expected to influence the robustness of the results.

Allocation

Allocation was applied only where shared energy inputs were used across multiple product lines at the **RAKfix** manufacturing facility. Electricity consumption, diesel use for internal handling, and water use were allocated using a mass-based approach, reflecting each product's proportional share of total annual production at the Ras Al Khaimah facility.

Raw materials—including limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, and other functional components—and all associated transport flows were modelled using product-specific primary data, as these inputs are directly dosed for **RAKfix** Bondcrete and do not require allocation. No economic allocation was applied, as the manufacturing process does not generate co-products.

Electricity

Electricity consumption in the LCA model is based on the UAE grid mix as represented in Ecoinvent v3.12 (Allocation, cut-off by classification). The UAE electricity supply is predominantly generated from natural gas, supplemented by coal, nuclear power, oil, and solar energy. The modelled grid composition is as follows:

Energy Source	Share (%)
Natural Gas - Combined Cycle Power Plant	39.78
Natural Gas - Conventional Power Plant	29.54
Hard Coal	18.70
Nuclear - Pressure Water Reactor	11.63

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Oil	0.18
Solar Thermal (Parabolic Trough), 50 MW	0.17

The climate impact associated with this electricity mix is 5.19E-01 kg CO₂e per kWh, and this factor is applied consistently to all electricity use across modules A1–A3 and relevant downstream stages. This approach ensures that electricity-related impacts accurately reflect UAE operational conditions and the energy landscape relevant to **RAKfix**'s Ras Al Khaimah facility.

Calculation Rules

The LCA model for **RAKfix** Bondcrete uses foreground data collected directly from the Ras Al Khaimah manufacturing facility, combined with background datasets sourced from ecoinvent v3.12 (allocation, cut-off by classification). These datasets provide emission factors for key inputs, including limestone fillers, Ordinary Portland Cement (OPC), polymer powders, cellulose-based additives, electricity consumption, diesel for internal handling, packaging materials, and transportation. Regionally representative conditions—such as UAE electricity mixes, supplier distances, and UAE-specific end-of-life practices—were incorporated where relevant to ensure representativeness.

Transport activities for raw material supply, packaging procurement, and finished product delivery are included based on actual supplier-to-plant and plant-to-customer distances. Road distances were measured using Google Maps, while sea freight transport is included for imported materials from Europe and Asia. Exclusions are limited to items of negligible relevance (<1%), such as administrative activities, office utilities, and capital equipment maintenance. Transport flows are therefore fully represented within the defined geographical scope.

Byproducts Assignment

No by-products are generated during the manufacturing of **RAKfix** Bondcrete. The process is a dry-mix operation involving physical blending of raw materials, with the only outputs being the finished product and minor process emissions associated with electricity use, internal material handling, and dust during transfer operations. As no co-products or secondary outputs are produced, allocation is not required within the manufacturing system boundary.



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In the following tables, the environmental performance of the declared unit “1 kilogram of **RAKfix** Bondcrete” is presented for **RAKfix**. This EPD covers multiple products (**RAKfix** 010, 012, 014, and 016) and is based on a worst-case scenario approach, with results corresponding to the product with the highest environmental impact, identified as **RAKfix** 014. Environmental impacts are calculated using EF 3.1 (ILCD), ensuring consistency with the applied life cycle impact assessment methodology.



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Core Environmental impact indicators

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

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Climate change (GWP) - fossil	Kg CO ₂ e	4.08E-01	3.75E-03	1.57E-02	4.28E-01	9.88E-03	0.00E+00	0.00E+00	4.94E-03	1.66E-02	3.13E-04	-4.80E-02
Climate change (GWP) - biogenic	Kg CO ₂ e	0.00E+00	0.00E+00	1.62E-02	1.62E-02	0.00E+00	-1.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Climate change (GWP) - LULUC	Kg CO ₂ e	1.90E-04	1.90E-06	2.29E-06	1.95E-04	4.65E-06	0.00E+00	0.00E+00	2.32E-06	2.07E-05	1.77E-07	-1.41E-04
Climate change (GWP) - total	Kg CO ₂ e	4.09E-01	3.75E-03	1.57E-02	4.29E-01	9.89E-03	0.00E+00	0.00E+00	4.94E-03	1.66E-02	3.13E-04	-4.85E-02
Ozone depletion	Kg CFC-11e	2.21E-09	5.00E-11	3.10E-10	2.57E-09	1.40E-10	0.00E+00	0.00E+00	7.00E-11	2.80E-10	9.14E-12	-6.24E-10
Acidification	mol H ⁺ e	1.33E-03	2.00E-05	1.20E-04	1.47E-03	2.00E-05	0.00E+00	0.00E+00	1.00E-05	1.30E-04	2.16E-06	-3.18E-04
Eutrophication, aquatic freshwater	kg PO ₄ ³⁻ eq	1.39E-04	7.86E-07	2.44E-06	1.42E-04	2.30E-06	0.00E+00	0.00E+00	1.15E-06	2.43E-05	8.47E-08	-4.66E-05
Eutrophication, aquatic freshwater	Kg P eq	4.52E-05	2.56E-07	7.95E-07	4.62E-05	7.50E-07	0.00E+00	0.00E+00	3.75E-07	7.93E-06	2.76E-08	-1.52E-05
Eutrophication, aquatic marine	Kg N eq	4.04E-04	7.98E-06	4.88E-05	4.60E-04	6.59E-06	0.00E+00	0.00E+00	3.29E-06	4.68E-05	8.60E-07	-9.69E-05
Eutrophication, terrestrial	mol N eq	4.46E-03	9.00E-05	5.30E-04	5.08E-03	7.00E-05	0.00E+00	0.00E+00	3.00E-05	5.00E-04	9.29E-06	-1.01E-03
Photochemical ozone formation	Kg NMVOC eq	1.32E-03	2.88E-05	1.64E-04	1.51E-03	3.82E-05	0.00E+00	0.00E+00	1.91E-05	1.61E-04	3.36E-06	-3.51E-04
Abiotic depletion, minerals & metals	Kg Sb eq	1.08E-06	1.03E-08	3.61E-08	1.12E-06	2.98E-08	0.00E+00	0.00E+00	1.49E-08	3.43E-08	4.70E-10	-7.80E-06
Abiotic depletion of fossil resources	MJ	2.03E+00	4.38E-02	1.65E-01	2.23E+00	1.22E-01	0.00E+00	0.00E+00	6.12E-02	2.29E-01	6.96E-03	-4.79E-01
Water use	m ³ depr.	4.72E-02	2.63E-04	1.10E-03	4.85E-02	7.97E-04	0.00E+00	0.00E+00	3.99E-04	5.78E-02	3.39E-04	-3.56E-02

The results of the environmental impact indicators — Abiotic depletion, Water use, and all optional indicators except Particulate matter and Ionizing radiation, human health — shall be used with care, as the uncertainties on these results are high or there is limited experience with the indicator. Reading example: 1.57E-03 = 1.57 × 10⁻³ = 0.00157.

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Additional environmental impact indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Particulate matter	Incidence	1.74E-08	3.24E-10	2.77E-10	1.80E-08	1.01E-09	0.00E+00	0.00E+00	5.05E-10	9.84E-09	5.06E-11	-7.66E-09
Ionizing radiation, human health	Kbq U-235 eq	4.51E-03	4.13E-05	1.30E-03	5.85E-03	1.25E-04	0.00E+00	0.00E+00	6.26E-05	2.62E-04	4.41E-06	-1.81E-03
Ecotoxicity (freshwater)	CTUe	9.39E-01	8.54E-03	2.29E-02	9.70E-01	2.47E-02	0.00E+00	0.00E+00	1.23E-02	9.73E-02	9.50E-04	-2.79E-01
Human toxicity, cancer effects	CTUh	3.51E-10	6.53E-13	1.60E-12	3.53E-10	1.58E-12	0.00E+00	0.00E+00	7.91E-13	3.48E-12	5.48E-14	-2.84E-10
Human toxicity, non-cancer effects	CTUh	2.48E-09	3.10E-11	4.73E-11	2.56E-09	9.47E-11	0.00E+00	0.00E+00	4.73E-11	1.42E-10	1.33E-12	-4.70E-10
Land use related impacts/soil quality	Dimensionless	2.86E+01	4.74E-02	1.39E-02	2.87E+01	1.55E-01	0.00E+00	0.00E+00	7.77E-02	2.73E-01	1.51E-02	-2.69E+01

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, or radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some construction materials is also not measured by this indicator.

GWP-GHG Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG	Kg CO ₂ e	4.09E-01	3.75E-03	-5.08E-04	4.13E-01	9.89E-03	1.62E-02	0.00E+00	4.94E-03	1.66E-02	3.13E-04	-4.85E-02

This indicator includes all greenhouse gases, excluding biogenic carbon dioxide uptake and emissions, as well as biogenic carbon stored in the product, as defined by IPCC AR6 (2021). The indicator aligns closely with the Global Warming Potential (GWP) outlined in EN 15804:2012+A2:2019, incorporating updated characterization factors and environmental impact indicators.

Resource Use Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	4.02E+00	7.00E-04	1.59E-03	4.02E+00	2.08E-03	0.00E+00	0.00E+00	1.04E-03	5.55E-03	7.19E-05	-3.73E+00
Renewable PER used as materials	MJ	4.84E-04	0.00E+00	1.08E-05	4.95E-04	0.00E+00	-4.95E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.51E-04

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Total use of renewable PER	MJ	4.02E+00	7.00E-04	1.60E-03	4.02E+00	2.08E-03	-4.95E-04	0.00E+00	1.04E-03	5.55E-03	7.19E-05	-3.73E+00
Non-renewable PER used as energy	MJ	2.03E+00	4.38E-02	1.65E-01	2.24E+00	1.22E-01	0.00E+00	0.00E+00	6.12E-02	2.29E-01	6.96E-03	-4.79E-01
Non-renewable PER used as materials	MJ	1.29E-06	0.00E+00	2.31E-09	1.29E-06	0.00E+00	-1.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.02E-06
Total use of non-renewable PER	MJ	2.03E+00	4.38E-02	1.65E-01	2.24E+00	1.22E-01	-1.29E-06	0.00E+00	6.12E-02	2.29E-01	6.96E-03	-4.79E-01
Use of secondary materials	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-02	0.00E+00
Radioactive waste	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output Flow Indicators

Impact Category	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for reuse	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.59E-01
Materials for recycling	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-01	0.00E+00	9.59E-01

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Materials for energy recovery	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy - thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content

Details	Unit	A1-A3
Biogenic carbon content in product	Kg C	0.00E+00
Biogenic carbon content in accompanying packaging	Kg C	0.00443

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO₂. "Reading example: 1.57E-03 = 1.57*10⁻³ = 0.00157"

Disclaimer: "According to the **EN 15804:2012+A2:2019** standard, the LCIA results are relative expressions translating impacts into environmental themes such as climate change, ozone depletion, etc. (midpoint impact categories). Thus, the LCIA results do not predict impacts on category endpoints such as impact on the extinction of species or human health. In addition, the results do not provide information about exceeding thresholds, safety margins or risks".



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Interpretation

The life cycle results for **RAKfix** Bondcrete demonstrate a strongly raw-material-dominated environmental profile, with Module A1 accounting for 88.88% of total GWP. This distribution is primarily driven by the use of Ordinary Portland cement (OPC), which is widely recognised as the principal source of emissions in cement-based formulations due to energy-intensive clinker production and process-related CO₂ emissions. Given the cementitious nature of the product and the limited transformation during manufacturing, the environmental profile is fundamentally governed by upstream material inputs.

Module A3 (3.41%) and A2 (0.814%) remain comparatively low due to the nature of the production process and supply chain structure. Manufacturing consists primarily of controlled dry mixing operations with no thermal processing or intended chemical reactions, resulting in minimal direct emissions. Inbound transportation impacts are also limited, as key raw materials such as cement and limestone are sourced locally within Ras Al Khaimah. Imported components such as polymer powders and cellulose additives contribute to A2 through sea and road transport; however, their overall influence remains minor due to their relatively low proportion in the formulation.

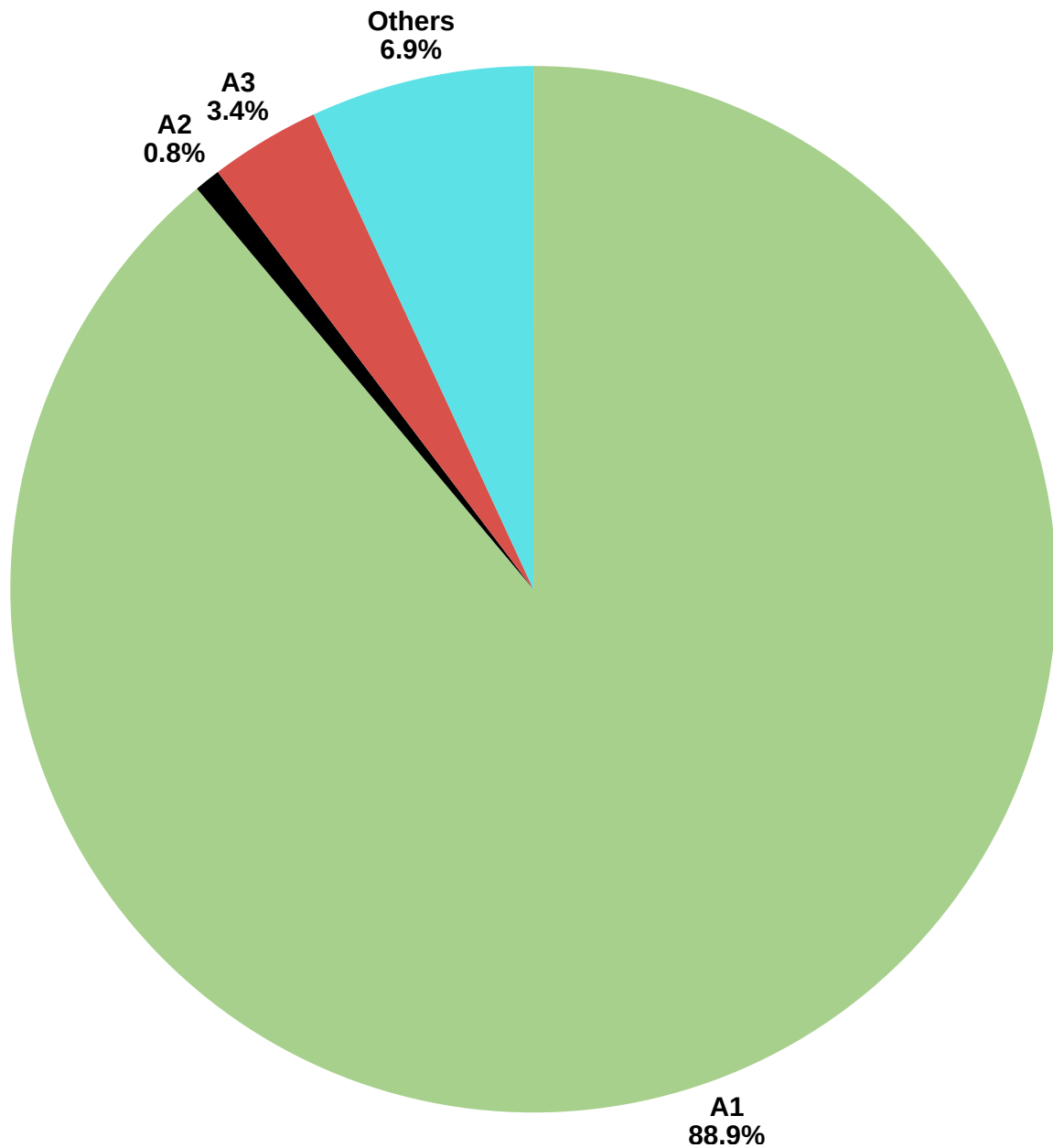
Module A4 (2.15%) represents a modest share of total GWP, reflecting the distribution of **RAKfix** Bondcrete exclusively within the United Arab Emirates. As outbound logistics are limited to domestic road transport, distribution-related impacts remain significantly lower than those observed in export-driven supply chains. Although the product is supplied in bagged and palletised form, relatively short transport distances and efficient load utilisation help contain the overall contribution of this module.

End-of-life modules show a moderate contribution, consistent with the behaviour of cementitious materials integrated within concrete systems. C1 is zero, as the product becomes fully embedded within the host structure and does not generate separate demolition burdens. C2 (1.073%) reflects transport of demolition waste to recycling and landfill facilities within the UAE, while C3 (3.61%) accounts for mechanical processing of mineral waste through crushing, separation, and screening operations at authorised facilities. C4 (0.07%) remains negligible, as inert mineral waste does not undergo biodegradation or generate landfill emissions. Overall, the impact distribution confirms a material-driven upstream profile with limited influence from transport and end-of-life stages, reinforcing the representativeness of the model for UAE-based construction applications.



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Life Cycle Stage Contribution to GWP (kg CO₂e per 1 kilogram of RAKfix Bondcrete)



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Mandatory Statements

Explanatory materials are available from the EPD Owner and/or LCA Author. The verifier and Program Operator make no claims and bear no responsibility regarding the legality of the study. Sole ownership, liability, and responsibility for the EPD lie with the EPD Owner. The LCA Author is not liable for manufacturer-provided information, life cycle data, or supporting evidence.

EPDs within the same product category, but issued by different EPD programs, may not be comparable. For valid comparison, both EPDs must be based on the same PCR (including version number), or on fully-aligned PCRs. Products must have identical function, technical performance, and use cases (e.g. the same declared or functional unit); share equivalent system boundaries, data descriptions, and data quality standards; use comparable collection methods and allocation rules; include matching content declarations; and be valid at the time of comparison.

Information related to EPD of multiple products

This is not an EPD of multiple products.

Information related to Sector EPD

This is not a sector EPD.

Differences vs previous versions

This is the second version of the EPD. See below for more details.

EPD Version Information

Version	Date	Program Operator	Registration Number
Original Issue	20-05-2021	International EPD System	SP-03814
Revision 1	21-05-2026	International Climate Intelligence System	ICIS-202605-135



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Total GWP Results Comparison (A1-A3)

Module	Previous LCA (ecoinvent v3.6) (kg CO ₂ e/kg)	Updated LCA (ecoinvent v3.12, cut-off) (kg CO ₂ e/kg)
A1	3.79E-01	4.09E-01
A2	5.85E-03	3.75E-03
A3	-5.62E-02	1.57E-02
A1-A3	3.29E-01	4.29E-01

The increase in A1–A3 GWP from 0.329 kg CO₂e/kg in the previous LCA (ecoinvent v3.6) to 0.429 kg CO₂e/kg in the updated LCA (ecoinvent v3.12, cut-off) is primarily attributable to updated background datasets, revised system modelling, and improved allocation of process burdens, rather than any change in product composition or manufacturing operations. The overall increase of approximately 0.100 kg CO₂e/kg is dominated by changes in Module A3, with additional contributions from A1, partially offset by a reduction in A2.

The most significant variation occurs in Module A3, which shifts from a negative value (-0.0562 kg CO₂e/kg) in the previous model to a positive value (0.0157 kg CO₂e/kg) in the updated model. Under standard EN 15804 modelling practice, manufacturing stages for cement-based dry-mix products are expected to show net positive emissions due to electricity use, internal handling, mixing, and packing operations. The negative A3 value in the earlier model is therefore understood to result from differences in modelling assumptions, dataset structures, or allocation approaches in the previous database version, rather than representing actual physical manufacturing conditions. In the updated model, A3 reflects only the direct manufacturing burdens, resulting in a more representative and conservative estimate of production-stage impacts. This correction accounts for approximately 0.072 kg CO₂e/kg of the total increase.

Module A1 increases from 0.379 to 0.409 kg CO₂e/kg (approximately +0.030 kg CO₂e/kg), reflecting updates to upstream datasets for key raw materials such as OPC, limestone fillers, polymer powders, cellulose additives, and packaging materials. The ecoinvent v3.12 update includes revisions across multiple sectors—such as fuels, electricity, chemicals, plastics, and material production—resulting in updated emission factors, regionalisation, and improved representation of supply chains. As noted in Ecoinvent v3.12 change documentation, such

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database-wide updates can influence life cycle impact results even when foreground data remains unchanged, due to modifications in activity links, emission factors, and modelling assumptions.

Module A2 shows a slight decrease from 0.00585 to 0.00375 kg CO₂e/kg, indicating minor changes in transport modelling. This is consistent with refinements introduced in ecoinvent v3.12 within the transport sector, including updates to road transport emissions and sea transport datasets, which can influence logistics-related impacts depending on dataset selection and regional assumptions.

Overall, the observed increase in A1–A3 GWP is considered technically justified and reflects improved data quality, updated background inventories, and more consistent allocation of manufacturing-stage burdens in line with the ecoinvent v3.12 cut-off modelling framework. The updated results therefore provide a more robust and conservative representation of the product's cradle-to-gate environmental performance.



REVIEW AND VERIFICATION

Program Operator	International Climate Intelligence System 71-75 Shelton Street Covent Garden London, WC2H 9JQ United Kingdom
Registration Number	ICIS-202605-135
Publication Date	21-05-2026
Valid Until	20-05-2031
Geographical Scope	United Arab Emirates (UAE)
Product category rules (PCR): PCR 2026:18 Construction products (EN15804:2012+A2:2019/AC:2021) Version 1.2.6 dated 21-Jan-2026	
PCR review was conducted by: International Climate Intelligence System	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 14040: <input type="checkbox"/> EPD Process Certification (internal) <input checked="" type="checkbox"/> EPD Verification (external)	
Third party verifier: Luis Manuel, International Climate Intelligence System	



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ACRONYMS

Acronym	Meaning
kg CO ₂ e	Kilograms of carbon-dioxide equivalent
kg CFC-11e	Kilograms of Chlorofluorocarbon-11 equivalent
mol H ⁺ e	Moles of hydrogen ion equivalent
kg PO ₄ ³⁻ eq	Kilograms of phosphate equivalent
kg P eq	Kilograms of phosphorus equivalent
kg N eq	Kilograms of nitrogen equivalent
mol N eq	Moles of nitrogen equivalent
kg NMVOC eq	Kilograms of non-methane volatile organic compound equivalent
kg Sb eq	Kilograms of antimony equivalent
MJ	Megajoules
m ³ depr.	Cubic meters of water deprived
incidence	Unit representing human health impact related to particulate matter exposure
Kbq U-235 eq	Kilo-becquerels of Uranium-235 equivalent
CTUe	Comparative Toxic Unit for ecosystems
CTUh	Comparative Toxic Unit for humans
dimensionless	Unitless characterization factor — used for land-use/soil quality impacts
kg C	Kilograms of biogenic carbon contained in product or packaging



STANDARDS AND REFERENCES

Standards & Methodological Frameworks

- EN 15804:2012 + A2:2019 / AC:2021 – Sustainability of construction works – Core rules for environmental product declarations of construction products.
- ISO 14025:2006 – Environmental labels and declarations – Type III environmental declarations – Principles and procedures.
- ISO 14040:2006 – Life cycle assessment – Principles and framework.
- ISO 14044:2006 – Life cycle assessment – Requirements and guidelines.

PCR & Program Documents

- PCR 2026:18 Construction Products, Version 1.2.6 – International Climate Intelligence System (EN 15804+A2 aligned).
- EPD General Program Instructions (GPI) of International Climate Intelligence System, v2.0, 2023.

Databases, Tools & Modelling Sources

- Ecoinvent v3.12, system model: Allocation, cut-off by classification.
- Ecoinvent Centre (2025). Documentation of Changes Implemented in the ecoinvent Database v3.12. Swiss Centre for Life Cycle Inventories, St. Gallen.
- Air.e.LCA Software v3.20.1.0 by Solid Forest – Used for LCA modelling and impact calculations.
- IPCC AR6 (2021) Characterization Factors – Applied for GWP indicators (where relevant).
- EF 3.1 (Environmental Footprint 3.1 method) – Used for all midpoint impact indicators.

Transport Calculation Tools

- Google Maps – Road transport distance calculations.
- PortDistance.com – Maritime transport distance calculations.

Biogenic Carbon Basis

- Intergovernmental Panel on Climate Change (2006). IPCC Guidelines for National Greenhouse Gas Inventories.
- Food and Agriculture Organization (2010). Global Forest Resources Assessment.
- European Commission Joint Research Centre (2010). ILCD Handbook – General Guide for Life Cycle Assessment.
- Confederation of European Paper Industries (2022). Paper Industry Sustainability Reports.

STANDARDS AND REFERENCES

End-of-Life & Recycling

- Dubai Municipality (2022). Construction and Demolition Waste Management and Recycling Guidelines. Government of Dubai, UAE.
- Tadweer (Abu Dhabi Waste Management Center) (2023). Construction and Demolition Waste Recycling Operations. Abu Dhabi, UAE.
- BEEAH Group (2023). Waste Recycling and Resource Recovery Operations. Sharjah, UAE.
- Ministry of Climate Change and Environment (MOCCA), UAE (2019). Guidelines for the Use of Recycled Aggregates in Infrastructure Projects.
- European Commission (2018). EU Construction and Demolition Waste Management Protocol. Brussels.
- National Wooden Pallet & Container Association (NWPCA) (2016). Pallet Recycling Study (conducted with Virginia Tech & USDA Forest Service).
- American Forest & Paper Association (AF&PA) (2023). Paper and Paperboard Recycling Statistics.

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