formula
SAINT-GOBAIN

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019 for:

Beta Hemihydrate Base (from natural gypsum)

Version: 1
Date of publication: 2023/10/06
Validity: 5 years
Valid until: 2028/10/05

EPD®
THE INTERNATIONAL EPD® SYSTEM

The International EPD®
Programme operator: EPD international AB
System Registration number:
S-P-10287

EPD Type: Multiple Products (average results)
Scope of the EPD®: Cradle-to-gate with options, Module C and Module D

Manufacturer address: Saint-Gobain Formula, Newark, NG24 3BZ

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

SAINT-GOBAIN

General Information

Company and EPD Information

Manufacturer: Saint-Gobain Formula
Site of Manufacture: Saint-Gobain Formula site located in Newark, UK, NG24 3BZ
Management System-related Certification: ISO 14001 [1], ISO 50001 [2], ISO 9001[3]

Product Name: Beta Hemihydrate Base (from natural gypsum)
EPD for Multiple Products: ☐ No ☒ Yes, the EPD represents the following products:
Fine Casting Plaster [4], Pottery Plaster [5], Sulfacal HH [6], Molda Calsuform, Molda Calsufine, Standard Casting Plaster [7] and Superfine Casting Plaster [8] and all products with codes starting 600A-, 605A-, 606A-, 611A-, 700A-, 700C-, 702A-, 703A-, 714B-, 800A-, 805A-, 806A-.
UN CPC CODE: 374 - Plaster, lime and cement

Owner of the declaration: Saint-Gobain Construction Products UK t/a Saint-Gobain Formula
EPD® prepared by: Charnett Chau (Charnett.chau@saint-gobain.com), Daniel Moss (Daniel.moss@saint-gobain.com) and Liz Stimpson (Liz.Stimpson@saint-gobain.com)

Geographical scope of the EPD®: United Kingdom
EPD® registration number: S-P-10287
Declaration issued: 2023/10/06 valid until: 2028/10/05
Demonstration of verification: an independent verification of the declaration was made, according to ISO 14025:2010 [9]. This verification was external and conducted by the following third party based on the PCR mentioned above.

Programme Information

PROGRAMME:	The International EPD® System [10]
ADRESS:	EPD International AB - Box 210 60 - SE-100 31 Stockholm - Sweden
WEBSITE:	www.environdec.com
E-MAIL:	info@environdec.com

CEN standard EN 15804:2012 + A2:2019 [11] serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 Construction Products, version 1.2[12]
PCR review was conducted by: The Technical Committee of the International EPD® System See www.environdec.com for a list of members.
Chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact - Contact via info@environdec.com
Independent third-party verification of the declaration and data, according to ISO 14025:2006:
☐ EPD process certification ☒ EPD verification
Third-party verifier: Andrew Norton
Director of Renuables – a.norton@renuables.co.uk
Approved by: The International EPD© System
Procedure for follow-up of data during EPD validity involves third part verifier: ☐ Yes ☒ No

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

Product Description

Product Description and Description of Use

This Environmental Product Declaration (EPD®) describes the environmental impacts of **1 kg of Beta Hemihydrate Base (from natural gypsum)**.

Beta Hemihydrate Base (from natural gypsum), or Beta HH Base (natural) is an unformulated hemihydrate plaster ($CaSO_4.^1/_2H_2O$) produced from naturally occurring high-purity gypsum mineral. It is off-white in colour. The product is used in different industries namely fibrous and decorative plasters, ceramics production, dental plasters and construction markets for multiple applications either as a raw material or as a base for customer formulations. Examples, where Beta HH Base (natural) is used as a raw material, are to produce decorative plaster pieces, casting moulds for ceramics and within feed material products. In the case of construction materials, the product can be used within jointing compounds, crack fillers, adhesives (wall/floor tiles), floor screeds, levelling compounds, prefabricated construction elements for interior walls and fire protection products.

Saint-Gobain Formula's Beta HH Base (natural), is a group of products derived from natural gypsum using the beta calcination process at Formula Newark; they are differentiated by their production process, particle size differences and the use of process aids (< 1% w/w) in their manufacture. As the production process for this product range differs slightly, the environmental impact differences amongst these products are < 0.5% over life cycle stages A1-A3. The developed LCA/EPD declare the average impact results of the Beta HH Base (natural) product range whereby the impact associated with the production and distribution of the products is weighted according to the product volumes.

Technical data/physical characteristics:

Bulk Density	800 - 900 kg/m^3
Particle Size Distribution (Mesh size and % weight retained)	15 – 33% at 63 µm, 30 – 50% at 32 µm

Declaration of the Main Product Components and/or Materials

All raw materials contributing more than 5% to any environmental impact are listed in the following table.

Product components	**Weight (%)**	**Post-consumer material weight (%)**
Natural Calcium Sulphate Hemihydrate	> 99	0
Process Aids (residues)	< 1	0
Sum	**100**	**0**
Packaging materials	**Weight (%)**	**Weight (kg)**
Composed bags (paper and PE)	19.8	0.0032
Corrugated Board	3.5	0.00058
HDPE Wrap	1.3	0.00022
PP Straps	1.4	0.00023
Wood (Pallet)	74	0.012

During the life cycle of the product, any hazardous substance listed in the “Candidate List of Substances of Very High Concern (SVHC) [13] for authorization” has not been used in a percentage higher than 0,1% of the weight of the product. The verifier and the program operator do not make any claim nor have any responsibility for the legality of the product.

LCA Calculation Information

TYPE OF EPD	Cradle to the gate with options, module C and module D
FUNCTIONAL UNIT	1 kg of Beta Hemihydrate Base (from natural gypsum)
SYSTEM BOUNDARIES	Mandatory Stages = A1 to A3, C and D Optional Stages = A4, A5 and B
REFERENCE SERVICE LIFE (RSL)	50 years. By default, it corresponds to standard building design life, and it is noted that plaster products are in place for this duration.
CUT-OFF RULES	In the case that there is not enough information, the process energy and materials representing less than 1% of the whole energy and mass used can be excluded (if they do not cause significant impacts). The addition of all the inputs and outputs excluded cannot be bigger than 5% of the whole mass and energy used, as well as emissions to the environment occurred. Flows related to human activities such as employee transport are excluded. The construction of plants, production of machines and transportation systems are excluded since the related flows are supposed to be negligible compared to the production of the building product when compared to these systems’ lifetime level.
ALLOCATIONS	The allocation criteria are based on the mass flow of products and co-products – i.e. mass allocation between the different product ranges produced at Saint-Gobain Formula Newark. Where raw materials and energy usage cannot be directly attributed to individual products the total quantity used in the factory was divided by the total mass of products produced to achieve materials and energy per kilogram of product.
GEOGRAPHICAL COVERAGE AND TIME PERIOD	Scope: UK (production), Global (use and disposal) Data is collected from one production site, Newark Saint-Gobain Formula Data collected for the year: **2022**
BACKGROUND DATA SOURCE	The databases Sphera v2023.1 [14] and ecoinvent v.3.8 [15]
SOFTWARE	LCA for Experts – Sphera v2023.1 [16]
LCA METHODOLOGY	In addition to EN 15804:2019+A2 and PCR 2019:14, the study was carried out in accordance with ISO 14040:2006 [17], ISO 14044:2006 [18], and GPI for the International EPD® system [19]

According to EN 15804:2012+A2:2019, EPDs of construction products may not be comparable if they do not comply with this standard. According to ISO 21930:2017 [20], EPDs might not be comparable if they are from different programmes.

LCA Scope

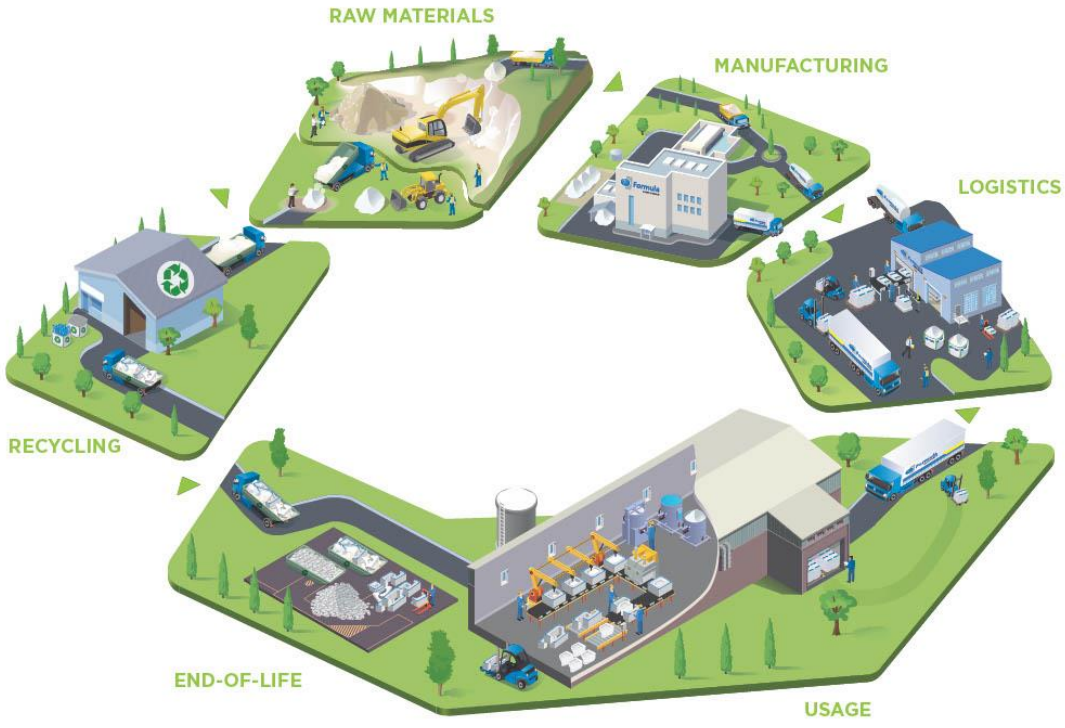
System boundaries (X=included. ND=not declared)

	PRODUCT STAGE			CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-recovery
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*	X	X	X	X	X	X	X	X	X	X	X	X
Geography	EU-28/GLO		GB	EU-28/GLO													
Specific data used	>90%**																
Variation products	<1%																
Variation sites	N/A																

*While the installation of the product was not modelled, the disposal of packaging was modelled at A5.

**Share of specific data that is specified according to PCR 2019:14. We gathered site-specific data on the generation of electricity provided by contracted suppliers (using Guarantee of Origin), transportation data on distances, means of transportation, load factor, fuel/other energy consumption at the site. The value in the table is calculated on the share of impact deriving from LCI data from databases on transportation and energy ware that are combined with actual transportation and energy parameters.

Life Cycle Stages



A1-A3, Product Stage

Description of the stage:
Modules A1-A3 sit within the product stage of a building's life cycle, where raw and secondary materials are extracted and processed (A1) before being transported (A2) to manufacturing facilities for the fabrication of building products (A3). Here we detail A1-A3 for a primary product range produced at Formula Newark. Information on the supply of materials and manufacturing of the product(s) were primary data from Saint-Gobain Formula. Secondary data from Sphera (2023.1) and ecoinvent (3.8) databases were used to obtain LCIs for input materials and the processing of waste materials. Electricity used at the Saint-Gobain manufacturing site was modelled based on the power mix purchased with the guarantee of origin (GO)/residue electricity mix from the UK market.

A1, Raw materials supply
Raw materials that are required to manufacture Beta Hemihydrate Base are supplied from various countries around the world, predominantly in the UK and Europe. These raw materials can be categorised as “virgin” materials (e.g. gypsum rock) and packaging materials (e.g. pallets)

The natural gypsum used for production is quarried from Bantycock quarry, a site owned by Saint-Gobain and operated by a third party Specific data was gathered from this quarry to model the impact of the raw material extraction of gypsum rock and the transportation to the Newark site. These activities have been allocated to A1 and A2, respectively.

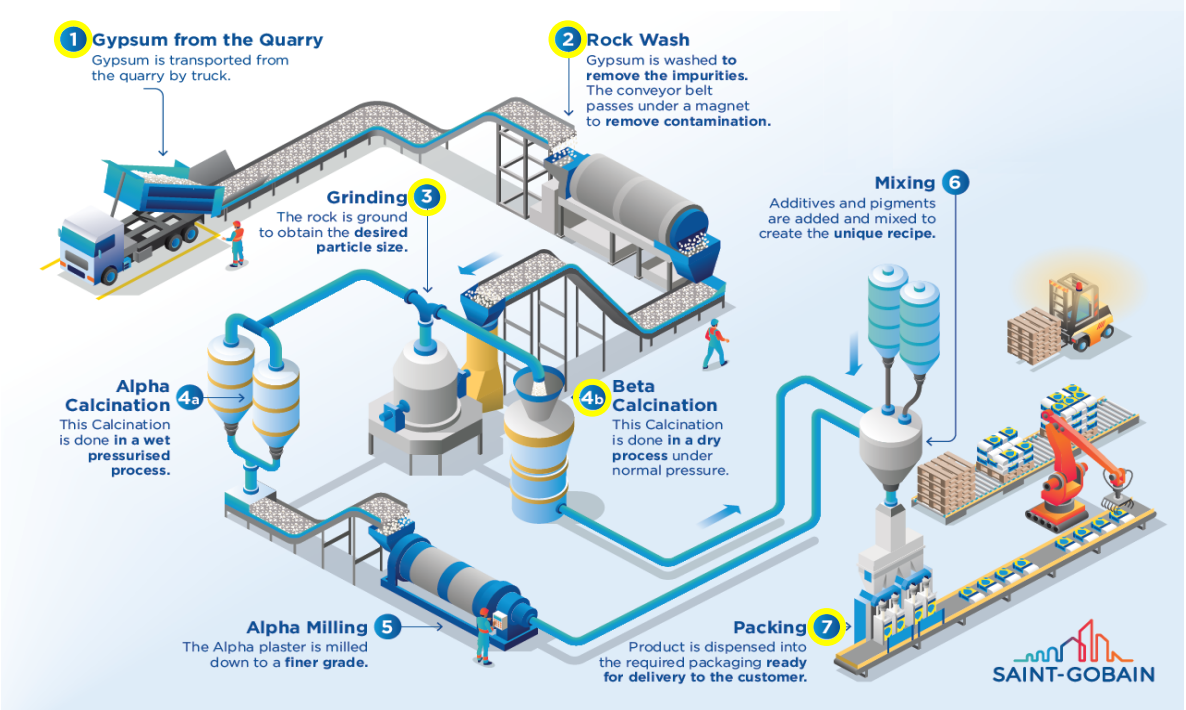
A2, Transport to the manufacturer
Virgin materials and packaging are transported to the manufacturing site in Newark.

A3, Manufacturing
The Newark site produces mainly natural gypsum-based products. For the production of Beta HH Base, gypsum rocks are quarried from a local Saint-Gobain-owned quarry in Bantycock (specific site data is used for the LCA) and delivered to Newark for processing. The rocks are washed and ground to particular sizes then fed for dry calcination.

Auxiliary processes include thermal energy generation for drying before and drying grinding, sieving products into the correct size and other properties, the transportation within the manufacturing site.

Manufacturing Process Flow Diagram

The system diagram below showcases all the main processes (Steps 1 to 7) that occur at the Saint-Gobain Formula, Newark, production site. Only the steps that are highlighted in yellow are relevant to Beta Hemihydrate Base (from natural gypsum) production.



A4-A5, Construction Process Stage

A4, Transport to the building site: Distribution distances of products were obtained by mapping the transport distances from the Newark manufacturing site to clients. The average distance was then taken along with the typical mode and load of transport to form the transport scenario. All clients were included in the calculation from the year 2022, no assumptions or cut-offs were made to find the average distribution distance. Additionally, it's assumed that no product is lost, broken or wasted during transportation due to the efficiency of our courier and our packing process.

NATIONAL PARAMETERS (99% OF SALES)	VALUE
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long-distance truck, boat, etc.	Long-distance truck: 22t payload capacity Euro 0 – 6 mix Fuel type: Diesel
Distance	191 km
Average Load Weight	18.7 tonnes
Bulk density of transported products*	800 - 900 kg/m^3
Average Utilisation	0.85

EXPORT PARAMETERS (1% OF SALES)	VALUE
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long-distance truck, boat, etc.	Long-distance truck: 22t payload capacity Euro 0 – 6 mix Fuel type: Diesel Container Ship: 43000 t payload capacity Fuel type: Heavy fuel oil
Road Distance	451.3 km
Truck Average Load Weight	18.7 tonnes
Truck Average Utilisation	0.85
Sea Distance	3215.6 km
Shipping Average Utilisation	0.7
Bulk density of transported products*	800 - 900 kg/m^3

A5, Installation in the building:
Due to the product's multiple uses in buildings, product installation was not modelled. However, the disposal of packaging materials upon the use of the product was evaluated. The worst-case scenario where packaging is disposed to landfill was modelled.

PARAMETER	QUANTITY PER KG OF BETA HH BASE (NATURAL)
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type) **PACKAGING ONLY**	Bag: 0.0006 kg Pallet: 0.0125 kg Corrugated Board Mats: 0.0006 kg HDPE Wraps: 0.0002 kg Polypropylene Straps: 0.0002 kg

B1-B7, Use Stage (excluding potential savings)

The use stage, related to the building fabric includes:

B1: Use (or application of the installed product)

This model represents any emissions to the environment of the installed product. Emissions to the environment are not attributable to gypsum/plaster products.

B2: Maintenance; **B3:** Repair; **B4:** Replacement; **B5:** Refurbishment

Plaster products in construction are assumed a product working life of 50 years (as the building lifespan). Once installation is complete, no actions or technical operations are required during the use stage until the end-of-life stage. Therefore, these products have no impact on these modules.

B6: Operational Energy Use; **B7:** Operational Water Use

Plaster products are not related to any electricity or water use during the operation of the building.

C1-C4, End of Life Stage

Description of the stage:
The end-of-life scenario for four product ranges was developed based on Saint-Gobain's own knowledge and confirmation of customers for the deconstruction and demolition of the product from the building (C1). The worst-case scenario was assumed for the final disposal of the product, which is landfill.

C1: The deconstruction and/or dismantling process of Beta HH Base (natural) is assumed to be deconstructed as part of the entire building. These processes mainly use energy for mechanical operations. In our case, a small amount of energy is considered 0.0437 MJ/m².

C2: As there is no data for the transport of waste after its use phase, the default distance of 100 km of an average truck used at 85% capacity was assumed.

C3: No waste processing for reuse, recovery and recycling was assumed.

C4: The worst-case scenario where 100% landfill of the product was assumed. Since Beta HH Base (natural) does not contain biogenic carbon, no balancing of biogenic carbon is needed.

Description of the scenarios and additional technical information for the end of life:

PARAMETER	VALUE/DESCRIPTION
Collection process specified by type	100% collected with mixed deconstruction and demolition waste sent to landfill
Recovery system specified by type	0 kg recycled
Disposal specified by type	1 kg to landfill
Assumptions for scenario development (e.g. transportation)	Waste is transported 100 km by truck from deconstruction/demolition sites to landfill

D, Reuse/Recovery/Recycling Potential

No secondary materials were used to manufacture this product and 100**%** of the product is landfilled at its EoL. There is no reuse, recovery, or recycling of this product. Hence, no recycling benefits are reported in Module D.

LCA Results

As specified in EN 15804:2012+A2:2019 and the Product-Category Rules, the environmental impacts are declared and reported using the baseline characterisation factors from the ILCD. Specific data has been supplied by the plant, and generic data come from Sphera and ecoinvent databases.

All emissions to air, water, and soil, and all materials and energy used have been included.

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

All figures refer to a declared unit of 1 kg of Beta HH Base (natural).

The following results correspond to a product range manufactured in a single plant: Newark.

Environmental Impacts

Environmental Indicators	PRODUCT STAGE	CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				REUSE, RECOVERY RECYCLING
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Climate change [kg CO2 eq.]	1.06E-01	1.71E-02	3.01E-02	0	0	0	0	0	0	0	4.48E-03	6.80E-03	0	1.46E-02	0
Climate change (fossil) [kg CO2 eq.]	1.25E-01	1.72E-02	3.98E-04	0	0	0	0	0	0	0	4.47E-03	6.83E-03	0	1.50E-02	0
Climate change (biogenic) [kg CO2 eq.]	-1.95E-02	-2.33E-04	2.97E-02	0	0	0	0	0	0	0	1.63E-06	-9.46E-05	0	-4.99E-04	0
Climate change (land use change) [kg CO2 eq.]	3.80E-05	1.54E-04	1.22E-06	0	0	0	0	0	0	0	3.65E-07	6.24E-05	0	4.67E-05	0
Ozone depletion [kg CFC-11 eq.]	6.70E-09	2.18E-15	5.13E-11	0	0	0	0	0	0	0	8.06E-10	8.76E-16	0	3.82E-14	0
Acidification terrestrial and freshwater [Mole of H+ eq.]	3.13E-04	4.53E-05	2.05E-06	0	0	0	0	0	0	0	2.91E-05	1.37E-05	0	1.07E-04	0
Eutrophication freshwater [kg P eq.]	4.50E-06	6.08E-08	4.55E-08	0	0	0	0	0	0	0	1.27E-07	2.46E-08	0	3.03E-08	0
Eutrophication marine [kg N eq.]	1.27E-04	1.73E-05	9.77E-06	0	0	0	0	0	0	0	1.27E-05	5.66E-06	0	2.75E-05	0
Eutrophication terrestrial [Mole of N eq.]	1.37E-03	1.96E-04	6.81E-06	0	0	0	0	0	0	0	1.39E-04	6.45E-05	0	3.03E-04	0
Photochemical ozone formation - human health [kg NMVOC eq.]	3.82E-04	3.87E-05	3.98E-06	0	0	0	0	0	0	0	3.86E-05	1.22E-05	0	8.31E-05	0
Resource use, mineral and metals [kg Sb eq.][1]	1.28E-07	1.10E-09	6.65E-10	0	0	0	0	0	0	0	1.75E-09	4.43E-10	0	6.93E-10	0
Resource use, energy carriers [MJ][1]	1.94E+00	2.30E-01	5.84E-03	0	0	0	0	0	0	0	5.02E-02	9.17E-02	0	2.00E-01	0
Water deprivation potential [m³ world equiv.][1]	1.72E-02	2.01E-04	1.86E-04	0	0	0	0	0	0	0	1.03E-04	8.14E-05	0	1.65E-03	0

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

Resources Use

Resources Use Indicators	PRODUCT STAGE	CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				D REUSE, RECOVERY, RECYCLING
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Use of renewable primary energy (PERE) [MJ]	9.69E-01	1.65E-02	2.15E-04	0	0	0	0	0	0	0	3.09E-04	6.68E-03	0	3.26E-02	0
Primary energy resources used as raw materials (PERM) [MJ]	4.37E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT) [MJ]	1.41E+00	1.65E-02	2.15E-04	0	0	0	0	0	0	0	3.09E-04	6.68E-03	0	3.26E-02	0
Use of non-renewable primary energy (PENRE) [MJ]	1.94E+00	2.31E-01	5.84E-03	0	0	0	0	0	0	0	5.02E-02	9.21E-02	0	2.00E-01	0
Non-renewable primary energy resources used as raw materials (PENRM) [MJ]	3.39E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (PENRT) [MJ]	1.94E+00	2.31E-01	5.85E-03	0	0	0	0	0	0	0	5.02E-02	9.21E-02	0	2.00E-01	0
Input of secondary material (SM) [kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW) [m3]	1.55E-03	1.81E-05	4.43E-06	0	0	0	0	0	0	0	2.39E-06	7.31E-06	0	5.05E-05	0

Waste Category & Output flows

	PRODUCT STAGE	CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				D REUSE, RECOVERY, RECYCLING
Waste Category & Output Flows	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Hazardous waste disposed (HWD) [kg]	1.17E-06	7.15E-13	6.25E-09	0	0	0	0	0	0	0	1.38E-07	2.85E-13	0	4.36E-12	0
Non-hazardous waste disposed (NHWD) [kg]	8.54E-03	3.50E-05	1.78E-02	0	0	0	0	0	0	0	3.11E-04	1.40E-05	0	1.00E+00	0
Radioactive waste disposed (RWD) [kg]	4.40E-06	4.29E-07	2.70E-08	0	0	0	0	0	0	0	3.45E-07	1.72E-07	0	2.28E-06	0
Components for re-use (CRU) [kg]	0.00E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling (MFR) [kg]	5.85E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Material for energy recovery (MER) [kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported electrical energy (EEE) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported thermal energy (EET) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Optional Indicators

	PRODUCT STAGE	CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				D REUSE, RECOVERY, RECYCLING
Optional Indicators	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Respiratory inorganics [Disease incidences]	5.38E-09	4.01E-10	3.03E-11	0	0	0	0	0	0	0	5.76E-10	8.89E-11	0	1.31E-09	0
Ionising radiation - human health [kBq U235 eq.]	2.95E-03	6.40E-05	2.23E-05	0	0	0	0	0	0	0	2.29E-04	2.57E-05	0	2.64E-04	0
Ecotoxicity freshwater [CTUe]	5.46E-01	1.63E-01	1.60E-02	0	0	0	0	0	0	0	3.04E-02	6.51E-02	0	1.09E-01	0
Cancer human health effects [CTUh]	9.73E-11	3.34E-12	1.74E-13	0	0	0	0	0	0	0	7.06E-12	1.33E-12	0	1.68E-11	0
Non-cancer human health effects [CTUh]	7.14E-10	1.84E-10	5.68E-12	0	0	0	0	0	0	0	3.53E-11	7.36E-11	0	1.85E-09	0
Land use [Pt]	2.25E+00	9.46E-02	9.98E-03	0	0	0	0	0	0	0	6.49E-03	3.83E-02	0	4.86E-02	0

Additional Voluntary Indicators from EN 15804 (according to ISO 21930:2017)

	PRODUCT STAGE	CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				REUSE, RECOVERY RECYCLING
Environmental Indicators	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Climate change [kg CO2 eq.][2]	1.25E-01	1.73E-02	3.99E-04	0	0	0	0	0	0	0	4.47E-03	6.90E-03	0	1.51E-02	0

[2] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

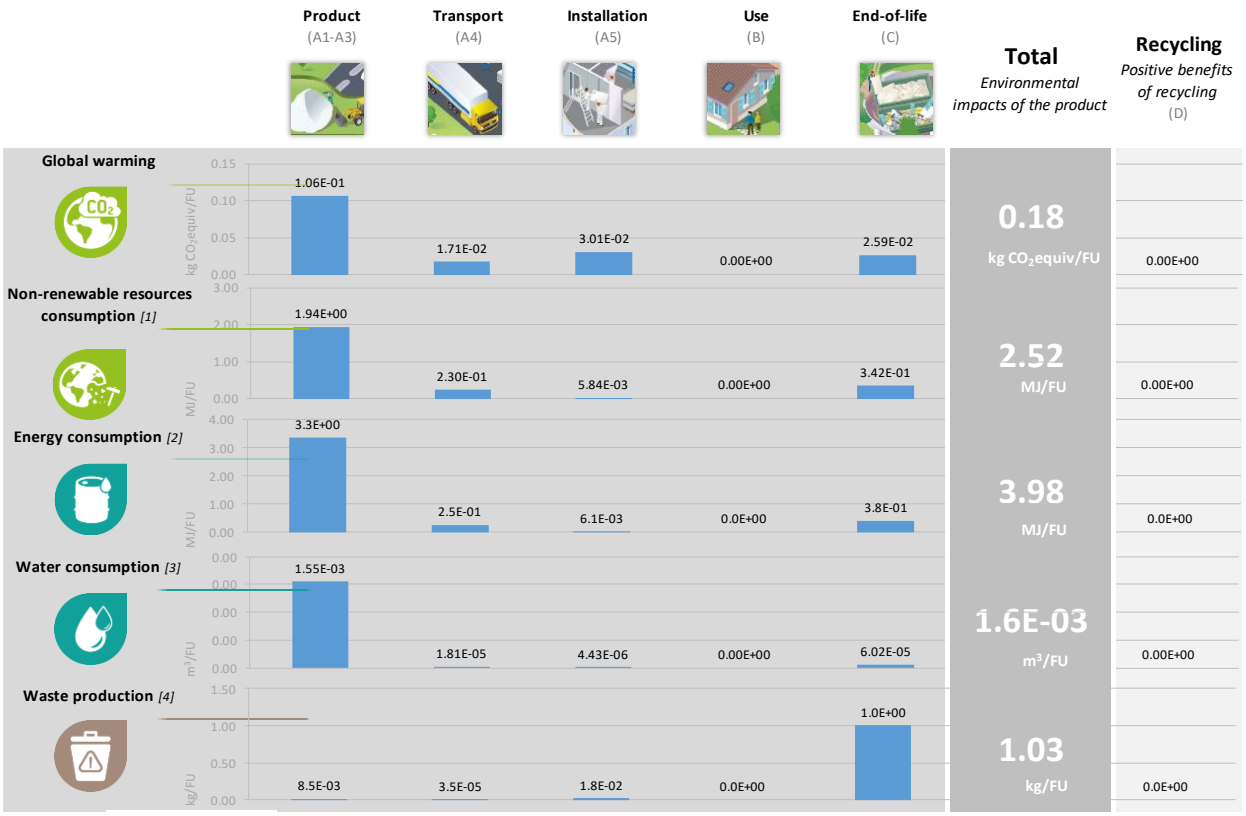
Information on Biogenic Carbon Content

Biogenic Carbon Content	BETA HEMIHYDRATE BASE
Biogenic carbon content in product [kg]	0 kg C eq.
Biogenic carbon content in packaging [kg]	6.24 E-03 kg C eq.

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2.

The product contains no biogenic carbon content. However, packaging has some biogenic carbon content, this is due to wooden pallets used for the tertiary packaging.

LCA Interpretation



[1] This indicator corresponds to the abiotic depletion potential of fossil resources.
[2] This indicator corresponds to the total use of primary energy.
[3] This indicator corresponds to the use of net fresh water.
[4] This indicator corresponds to the sum of hazardous, non-hazardous and radioactive waste disposed.

Climate Change (total)
The figure above breaks down the GWP of Beta HH Base (natural) into clear categories to understand the modules that cause the largest environmental impact. Most impact derives from Module A1-A3, contributing 59.2% to the overall Climate Change impact value. Further analysis showed that Module A3 contributes 0.0848 $kgCO_2eq/kg$ (47.4% of the total), which derives mainly from the use of natural gas for thermal steam (~91% of A3). The main source of impact from the supply of raw materials (A1 & A2) is the supply of gypsum rock (~17% of the total). In A4 (which contributed 9.55% of the total), the model considered the product being distributed both nationally and internationally, requiring both diesel-operated HGVs and HFO-operated containerships. In addition, Module A5 generated a 16.8% impact, this can be attributed mainly to the release of biogenic carbon stored in packaging materials at their disposal.

Non-renewable Resources Consumptions
The consumption of non-renewable resources has the highest value during the product stage (Module A1-A3) – 77.1%. 47.4% of the total non-renewable resource consumption stems from Module A3. This can be attributed mainly to the use of natural gas to produce thermal energy. The second highest contributing module is A1, generating 22.4% of the total impact. The gypsum quarry employed is operated using diesel as the only energy source, which has generated a noticeable impact on the overall score. In addition, as distribution requires diesel-operated HGVs and HFO-operated containerships, Module A4 contribute 9.13% to the total. While in Module C, where the product is demolished from the building (assumed diesel-operated machinery) and subsequently landfilled, contributes 13.6% towards the total.

Energy Consumption
Energy consumption combines both the total use of renewable primary energy resources and the total use of non-renewable primary energy resources. The highest contributing modules are A1 (49.3%) and A3 (34.6%). This can be attributed to the energy requirements for quarrying gypsum and for processing the rocks into the final product at the manufacturing site, respectively. Other modules that have a noticeable contribution to the overall score are Module A4 (6.21%) where fuel is required for distributing the product nationally and internationally and Module C (9.60%) where energy is used to dispose of the product.

Water Consumption
Water consumption is the use of freshwater throughout the product's life cycle. The highest contributor is the product stage (A1-A3) – 94.9 The main sources of water consumption in Module A1-A3 lie with electricity generation (30.1% of the total) and water consumed during rock washing (47.8% of the total). All other modules contribute <5% or less to the overall impact. All other modules contribute <5% or less to the overall impact.

Waste Production
Waste production includes all hazardous, non-hazardous and radioactive waste disposed of. Waste production doesn't follow the same trend as the other environmental impacts. For Beta HH Base (natural) >99.5% of the waste generated is at Module C, where products are assumed landfilled at their end of life. While there is waste produced in other life cycle stages (namely process wastes in Modules A1 and A3, and packaging disposal in Module A5), per declared unit, it can be deemed minimal.

Additional Information

Electricity Information

TYPE OF INFORMATION	DESCRIPTION
Electricity Purchaser	Saint-Gobain Construction Product UK Limited (incl. Saint-Gobain Formula)
Electricity Provider	Smartest Energy Ltd
Electricity Mix	Hydro – 30.8% Solar PV – 28.5% Wind – 40.7%
Reference year	2021-2022
Type of dataset	Sphera Database 2023.1, all datasets reference 2022 emissions - Hydro “GB: Electricity from hydro power Sphera” - Solar PV “GB: Electricity from photovoltaic Sphera” - Wind “GB: Electricity from wind power Sphera”
CO_2 emission kg CO_2 eq. / kWh	Certificate issue = 0 kgCO_2/kWh Modelled impact = 0.029 kgCO_2/kWh

Data Quality

Inventory data quality is judged by geographical, temporal, and technological representativeness. To cover these requirements and to ensure reliable results, first-hand industry data crossed with LCA background datasets were used. The data was collected from internal records and reporting documents from Saint-Gobain Formula. After evaluating the inventory, according to the defined ranking in the LCA report, the assessment reflects good inventory data quality.

Environmental Impacts According to EN 15804:2012 + A1

The following tables presents results of 1 kg of installed Beta Hemihydrate Base.

	PRODUCT STAGE	CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE				REUSE, RECOVERY, RECYCLING
Environmental Impacts	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Global Warming Potential (GWP) [kg CO2eq.]	1.04E-01	1.66E-02	2.76E-02	0	0	0	0	0	0	0	4.42E-03	6.62E-03	0	1.42E-02	0
Ozone depletion (ODP) [kg CFC 11eq.]	5.40E-09	2.57E-15	4.07E-11	0	0	0	0	0	0	0	6.38E-10	1.03E-15	0	4.50E-14	0
Acidification potential (AP) [kg SO2eq.]	2.27E-04	3.28E-05	1.59E-06	0	0	0	0	0	0	0	2.08E-05	9.61E-06	0	8.48E-05	0
Eutrophication potential (EP) [kg (PO4)3-eq.]	6.69E-05	6.60E-06	4.71E-05	0	0	0	0	0	0	0	5.15E-06	2.22E-06	0	9.62E-06	0
Photochemical ozone creation (POCP) - [kg Ethylene eq.]	3.06E-05	-5.80E-06	1.36E-06	0	0	0	0	0	0	0	2.72E-06	-2.26E-06	0	6.38E-06	0
Abiotic depletion potential for non-fossil resources (ADP-elements) [kg Sb eq.]	1.28E-07	1.10E-09	6.65E-10	0	0	0	0	0	0	0	1.75E-09	4.45E-10	0	7.07E-10	0
Abiotic depletion potential for fossil resources (ADP-fossil fuels) [MJ]	1.87E+00	2.26E-01	5.67E-03	0	0	0	0	0	0	0	4.98E-02	9.03E-02	0	1.92E-01	0

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