ENVIRONMENTAL PRODUCT DECLARATION

SCHLUTER FAST-SET™ TILE ADHESIVE

IMPROVED MODIFIED THIN-SET CEMENT MORTAR FOR TILE INSTALLATION
MANUFACTURED IN NORTH AMERICA

Schluter SET™ rapid-setting modified thin-set mortar specifically formulated for use with Schluter membranes and boards; ideal for fast-track projects.

Schluter® Systems

As a global company, Schluter-Systems is aware of its social responsibilities. From the start, we've chosen to incorporate recycled material into the manufacturing of many of our products. We also strive to reuse and recycle scrap and regrind materials in production, thus diverting materials from the waste stream. We favor local sources for raw material and production whenever possible to reduce transportation and support local business.

Our commitment to the environment goes beyond our products. The Schluter-Systems office facilities in North America are heated and cooled using geothermal technology to reduce dependence on non-renewable resources. Geothermal energy is clean, sustainable energy which eliminates harmful emissions, helping to keep our air and water clean. This alternative to the traditional use of fossil fuels allows us to eliminate our heating and cooling system's production of harmful emissions.

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ENVIRONMENTAL PRODUCT DECLARATION
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ENVIRONMENTAL PRODUCT DECLARATION

SCHLUTER FAST-SET™ THIN-SET TILE ADHESIVE
AS DEFINED BY ANSI A118.15

According to ISO 14025 and EN 15804

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Schluter Systems
DECLARATION NUMBER	4787455040.103.1
DECLARED PRODUCT	Schluter All-Set Rapid Setting Modified Thin-Set Title Adhesive, defined by ANSI A118.15
REFERENCE PCR	IBU Part B for Mineral factory-made mortar, with UL addendum (2016)
DATE OF ISSUE	January 17, 2018
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	PCR Review Panel Independent Expert Committee (SRV)
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Grant R. Martin Grant R. Martin, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria Thomas P. Gloria, Industrial Ecology Consultants

This EPD conforms with EN 15804

ENVIRONMENTAL PRODUCT DECLARATION

SCHLUTER FAST-SET™ THIN-SET TILE ADHESIVE
AS DEFINED BY ANSI A118.15

According to ISO 14025

Product Definition

Product Description

Cement mortar for tile installation is a blend of cement, very finely graded sand, fly ash and water retention compounds that allow the cement to properly hydrate. Its primary function is to adhere tile to a substrate, and it may contain polymers or other additives to improve adhesion, accommodate movement, and add strength.

Cement mortar is capable of withstanding a wide range of environmental stresses. Once cured, it is durable, fire- and heat-resistant, non-combustible, non-sensitive to moisture, and maintenance-free.

Schluter FAST-SET™ mortar is an unmodified dry-set cement mortar that is produced in two variants – grey and white, which differ mainly in the quantities of white cement, grey cement and fly ash used in the product recipe. Results presented in this EPD are based on a 50:50 mix of these two variants.

Applications

Dry-set cement mortar products are commonly used in interior, exterior, commercial, institutional, and residential tile installations.

Product Standards

Schluter FAST-SET™ thin-set tile adhesive meets or exceeds the Technical Specification ANSI A118.15 – American National Standard Specifications for Improved Modified Dry-Set Cement Mortar (ANSI, 2012).

Technical Data

Key physical properties of Schluter FAST-SET™ cement mortar are described in Table 1, below.

Table 1: Physical properties of Schluter FAST-SET™ cement mortar

Characteristics	Value
Compressive strength	Not relevant*
Adhesive shear strength	Conforms to ANSI: A118.15 (ANSI, 2012)
Water absorption	Not relevant*
Water vapor diffusion equivalent air layer thickness	Not relevant*
Thermal conductivity	Not relevant*
Tensile bond strength	Conforms to ISO 13007 (ISO, 2010)
Flexural strength	Conforms to ISO 13007 (ISO, 2010)

* Property is not relevant and/or not standardized for cement mortar for tile installation.

Cement mortar is non-flammable and non-combustible. No environmental burdens are expected due to unforeseen flooding or mechanical destruction.

Material Composition

The material composition of Schluter FAST-SET™ cement mortar is given in Table 2, below (note, this is the average composition based on both white and grey product variants.

Table 2: Material composition of Schluter FAST-SET™ cement mortar

Material	Composition
Sand	61%
White cement	21%
Grey cement	14%
Fly ash	4%
Other additives	2%

Mortar Production

Production Route

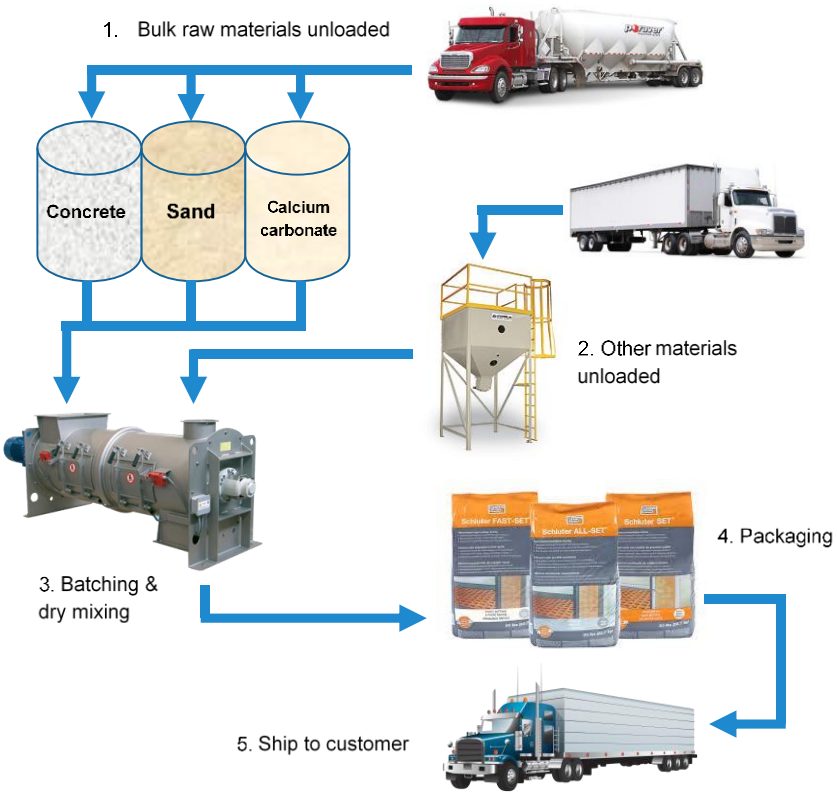

Figure 1: Process flow diagram for manufacturing cement mortar for tile installation

Raw materials, including cement, sand, fly ash, calcium chloride and other modifiers are unloaded and temporarily stored. When needed for production, materials are retrieved from storage, placed into specific batches based on formulation, dry-mixed, and then placed into packaging (usually bags). Packaged materials are then palletized, subjected to quality assurance inspections, placed into warehouse storage, and finally shipped to the customer warehouse or job site. All manufacturers of products represented by this EPD are governed by federal and local

requirements for dust control. Where applicable, they have incorporated dust collection systems in their processes to optimize material usage and mitigate airborne dust and particulate matter within the factory.

Manufacturing losses

All wastes and scrap generated during product manufacture are recycled back into the product, making a closed loop production process and maximizing the efficient use of material. Dust emissions arising during the mixing of the mortar are collected through a dust collection system and recycled back into the production line.

Packaging

Primary packaging is in paper/plastic composite bags, each holding 50 lbs of product. Secondary/tertiary packaging consists of shrink film and pallets. Packaging is assumed to be sent to landfill after installation. Landfill emissions from packaging are allocated to installation, while electricity generated from landfill gas (produced from the decomposition of bio-based packaging) is credited to the installation phase of the life cycle.

Delivery and Installation

Delivery

For purposes of this study, the average transport distance from manufacturing to construction site was assumed to be 500 miles (805 km) by truck.

Installation

Tile should not be installed until any and all structural damage to the building has been adequately repaired and determined to be code compliant. Surfaces must be structurally sound, stable, and rigid enough to support the mortar, grout, and tile, in addition to any other tile installation products.

Cement mortar for tile installation is usually installed by hand. The mortar is applied to a pre-fixed substrate using a notched trowel, tiles are then pressed into the mortar which is allowed to cure for a specified amount of time. Approximately 0.833 lb./ft.^{2} (4.07 kg/m^2) mortar is applied to the surface. Around 4.5% of material used is lost as waste and is assumed to be disposed of in a landfill.

Environment and Health during Use

Due to its material composition, mortar is typically quite alkaline and, as such, eye and skin contact should be avoided, especially for prolonged periods. In addition, precautions should be taken to reduce dust emissions and inhalation during installation. The installation safety instructions of the mortar product should be followed during application.

Cement mortar products do not emit VOC’s during application or use.

Use Stage and Reference Service Life

The service life of mortar is unique in that does it not depend on the amount of floor traffic and the type and frequency of maintenance. Mortar is replaced only when the ceramic tile is replaced. Since tile is assumed to have a service life equivalent to that of a building’s reference service life (RSL)—that is, 60 years—the mortar is thus assumed to also

have a 60-year RSL.

Tile adhesive does not require any maintenance or cleaning during the use stage as it is shielded from the external environment by the tile and grout installed on top of it. The main results are based on a declared unit of 1 kg tile adhesive.

The EPD presents results for the full 60 year RSL of the product, including the use stage impacts associated with that service life. Other scenarios such as the impacts for a one-year service life or per m^2 of installed tile that are also of interest are included in the appendix.

End of Life

As mortar is bound to the tile during application, it is typically disposed with the tile and, as such, can be used in multiple applications—for example, clean fill material in land reclamation/contouring projects, base or substrate material for roadways and/or parking lots, replacement for raw materials used in cement or brick kilns, etc. However, for purposes of this EPD, the analysis adopts the most conservative approach and assumes that 100% of all tile removal waste is disposed of in a landfill.

Life Cycle Assessment

A full life cycle assessment (LCA) was carried out according to ISO 14025 (ISO, 2006), ISO 14040 (ISO, 2006), and ISO 14044 (ISO, 2006), per the Product Category Rules (PCR) for Mineral Factory-made Mortar, as published by Institut Bauen und Umwelt e.V. (IBU, 2014), and the addendum as published by UL Environment (UL, 2016).

Declared Unit

The declaration refers to the declared unit of 1 kg of product.

Results for the mortar required in 1 m^2 installed tile are included in the appendix.

Table 3: Declared unit

Material	Value	Unit
Declared unit	1	kg
Gross density	1,394	kg/m^3
Application rate	4.07	kg/m^2
Conversion factor to 1 m^2	0.246	kg

System Boundary

The chosen system boundary for this study is cradle to gate with options and the life cycle stages considered are summarized in Table 4.

Table 4: Life cycle modules included in EPD

Production			Installation		Use stage							End-of-Life				Next product system
Raw material supply (extraction, processing, recycled material)	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing for reuse, recovery or recycling	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	MND	X	MND

X = declared module; MND = module not declared

Cut-off Criteria

No cut-off criteria were applied in this study. All reported data were incorporated and modeled using best available life cycle inventory (LCI) data.

Background Data

For life cycle modeling of the considered products, the GaBi ts Software System for Life Cycle Engineering, developed by thinkstep AG, was used to model the product systems considered in this assessment. All relevant background datasets were sourced from the GaBi 2017 database. The datasets from the GaBi database are documented in the online documentation (thinkstep, 2017).

Data Quality

A variety of tests and checks were performed throughout the project to ensure the high quality of the completed LCA. Checks included an extensive review of project-specific LCA models, as well as the background data used.

Temporal Coverage: Primary data collected from Schluter-Systems covered production over a four month period from January – April 2017. Background datasets are primarily based on data from the last 5 years (since 2012), with the exception of cement, which dates from 2004.

Technological Coverage: Data on material composition and manufacturing are based on primary information supplied by Schluter-Systems.

Geographical Coverage: This background LCA represents Schluter FAST-SET™ tile adhesive manufactured at Schluter-Systems' newly commissioned plant in Plattsburgh, NY. The regional electricity grid mix was used to model impacts associated with purchased electricity. Proxy datasets were used as needed for raw material inputs to address

a lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their technological representativeness of the actual materials.

Allocation

Co-Product Allocation: Manufacturing inputs, such as electricity use, were were allocated by mass to the respective products produced at the manufacturing facility. No other co-product allocation occurs in the foreground product system.

Multi-Input Processes Allocation: No multi-input allocation occurs in the foreground product system.

Reuse, Recycling, and Recovery Allocation: No post-consumer recycled content is used in Schluter FAST-SET™. Product and packaging waste are modeled as being disposed in a landfill rather than incinerated or recycled. Plastic and other construction waste is assumed to be inert in landfills so no system expansion or allocation is necessary as landfill gas is not produced. Electricity generated from landfill gas produced from the decomposition of bio-based packaging is credited to the installation phase of the life cycle.

Scenarios and Additional Technical Information

Information relevant to the life cycle modules included in this study are summarized in the following tables.

Table 5: Transport of 1 kg mortar to the building site (A4)

Aspect	Value	Unit
Liters of fuel	0.0024*	L/(100 km.kg)
Transport distance	805	km
Capacity utilization (including empty runs)	78	%

*Equivalent to a fuel consumption of 38.8 L/100 or 6.0 mpg

Table 6: Installation of 1 kg mortar at the building site (A5)

Aspect	Value	Unit
Water consumption	0.00026	m^3
Material loss (to landfill)	0.0455	kg
Dust in the air	Not measured	kg

Table 7: Reference service life

Aspect	Value	Unit
Reference service life	60	year

Table 8: End of life

Aspect	Value	Unit
Collected as mixed construction waste	1	kg
Landfilled	1	kg

Life Cycle Assessment – Results and Analysis

Results

Results for one kg installed mortar over the service life of 60 years are presented below. Results for the mortar required in 1 m^2 installed tile, as well as the impacts of a one-year service life, are included in the appendix.

POTENTIAL ENVIRONMENTAL IMPACTS

CML 2001 (April 2013)

Parameter	Unit	A1-3	A4	A5	C2	C3
GWP	kg CO_2-eq.	5.26E-01	6.13E-02	9.46E-03	2.41E-03	4.38E-02
ODP	kg CFC11-eq.	1.36E-09	5.08E-13	3.52E-14	1.99E-14	6.43E-13
AP	kg SO_2-eq.	2.64E-03	2.12E-04	3.12E-05	8.30E-06	1.89E-04
EP	kg $(PO_4)^{3-}$ eq.	2.13E-04	5.68E-05	3.47E-05	2.23E-06	2.42E-05
POCP	kg Ethene eq.	1.73E-04	2.17E-05	9.50E-06	8.52E-07	1.62E-05
ADPE	kg Sb eq.	8.52E-07	1.04E-08	1.00E-09	4.09E-10	1.82E-08
ADPF	MJ	3.69E+00	8.62E-01	3.85E-02	3.38E-02	6.84E-01

TRACI 2.1

Parameter	Unit	A1-3	A4	A5	C2	C3
GWP	kg CO_2-eq.	5.26E-01	6.13E-02	9.46E-03	2.41E-03	4.38E-02
ODP	kg CFC11-eq.	1.73E-09	5.40E-13	3.74E-14	2.12E-14	6.83E-13
AP	kg SO_2-eq.	2.65E-03	2.84E-04	6.98E-05	1.12E-05	2.05E-04
EP	kg N-eq.	8.63E-05	2.34E-05	3.24E-05	9.18E-07	1.04E-05
SFP	kg O_3-eq.	3.78E-02	9.41E-03	3.29E-04	3.69E-04	4.04E-03

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; SFP = Smog formation potential

RESOURCE USE

Parameter	Unit	A1-3	A4	A5	C2	C3
PERE	MJ	1.08E+00	2.15E-02	2.63E-03	8.44E-04	4.81E-02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.08E+00	2.15E-02	2.63E-03	8.44E-04	4.81E-02
PENRE	MJ	3.95E+00	8.67E-01	3.95E-02	3.40E-02	7.02E-01
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.95E+00	8.67E-01	3.95E-02	3.40E-02	7.02E-01
SM	kg	3.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	kg	7.93E-04	1.06E-04	1.71E-04	4.15E-06	8.67E-05

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM= Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

OUTPUT FLOWS AND WASTE QUANTITIES						
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**C2**	**C3**
HWD	kg	1.14E-08	7.08E-09	1.49E-10	2.78E-10	2.51E-09
NHWD	kg	6.75E-04	3.20E-05	5.09E-02	1.26E-06	1.00E+00
RWD	kg	5.56E-05	1.90E-06	3.82E-07	7.45E-08	7.01E-06
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	2.05E-03	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	9.65E-04	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

Interpretation

The CML 2001 (Apr. 2013) and the TRACI 2.1 life cycle impact assessment methodologies differ due to their distinct modeling approaches as well as to the regions they represent. Even so, both approaches find that the production of raw materials and energy for manufacturing are the two largest contributors in all impact categories considered. The installation of mortar is also a small but relevant contributor to abiotic depletion (fossil) and fresh water use. As raw material production and manufacturing are such large contributors to impacts in both impact assessment methods, the formulation of mortar would be the most effective area to focus burden reduction efforts.

These results do not constitute a comparative assertion, though architects and builders will be able to use them to compare TCNA's products with similar products presented in other EPDs that follow the same PCR.

References

ANSI. (2012). *A118.15 American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.* ANSI.

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Appendix – Additional Results

The following two sections tabulate environmental impacts of the mortar life cycle under two additional scenarios.

Results for 1 m^2 of installed mortar over a 60-year service life

The impacts of the life cycle of 1 m^2 of installed mortar over a 60-year service life are presented here.

POTENTIAL ENVIRONMENTAL IMPACTS

CML 2001 (April 2013)

Parameter	Unit	A1-3	A4	A5	C2	C3
GWP	kg CO_2-eq.	2.14E+00	2.49E-01	3.85E-02	9.81E-03	1.78E-01
ODP	kg CFC11-eq.	5.54E-09	2.07E-12	1.43E-13	8.10E-14	2.62E-12
AP	kg SO_2-eq.	1.07E-02	8.63E-04	1.27E-04	3.38E-05	7.69E-04
EP	kg $(PO_4)^{3-}$ eq.	8.67E-04	2.31E-04	1.41E-04	9.08E-06	9.85E-05
POCP	kg Ethene eq.	7.04E-04	8.83E-05	3.87E-05	3.47E-06	6.59E-05
ADPE	kg Sb eq.	3.47E-06	4.23E-08	4.07E-09	1.66E-09	7.41E-08
ADPF	MJ	1.50E+01	3.51E+00	1.57E-01	1.38E-01	2.78E+00

TRACI 2.1

Parameter	Unit	A1-3	A4	A5	C2	C3
GWP	kg CO_2-eq.	2.14E+00	2.49E-01	3.85E-02	9.81E-03	1.78E-01
ODP	kg CFC11-eq.	7.04E-09	2.20E-12	1.52E-13	8.63E-14	2.78E-12
AP	kg SO_2-eq.	1.08E-02	1.16E-03	2.84E-04	4.56E-05	8.34E-04
EP	kg N-eq.	3.51E-04	9.52E-05	1.32E-04	3.74E-06	4.23E-05
SFP	kg O_3-eq.	1.54E-01	3.83E-02	1.34E-03	1.50E-03	1.64E-02

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; SFP = Smog formation potential

RESOURCE USE

Parameter	Unit	A1-3	A4	A5	C2	C3
PERE	MJ	4.40E+00	8.75E-02	1.07E-02	3.44E-03	1.96E-01
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	4.40E+00	8.75E-02	1.07E-02	3.44E-03	1.96E-01
PENRE	MJ	1.61E+01	3.53E+00	1.61E-01	1.38E-01	2.86E+00
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.61E+01	3.53E+00	1.61E-01	1.38E-01	2.86E+00
SM	kg	1.47E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	kg	3.23E-03	4.31E-04	6.96E-04	1.69E-05	3.53E-04

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM= Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

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OUTPUT FLOWS AND WASTE QUANTITIES						
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**C2**	**C3**
HWD	kg	4.64E-08	2.88E-08	6.06E-10	1.13E-09	1.02E-08
NHWD	kg	2.75E-03	1.30E-04	2.07E-01	5.13E-06	4.07E+00
RWD	kg	2.26E-04	7.73E-06	1.55E-06	3.03E-07	2.85E-05
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	8.34E-03	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	3.93E-03	0.00E+00	0.00E+00

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

Results for 1 kg of installed mortar over a 1-year service life

As mortar requires no maintenance over its service life, the impacts of the life cycle of 1 kg of installed mortar over a one-year service life are equal to the impacts of 1 kg of installed mortar over a 60-year service life, as presented in the body of this EPD.

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