Declaration Owner

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Product

Click Tile (5.0mm)

(UNSPSC Class Code 30161707/CSI Code 09 65 00)

Functional Unit
The functional unit is one square meter of flooring installed and maintained over a 75-year period.

EPD Number and Period of Validity
SCS-EPD-10173
EPD Valid June 6, 2024 through June 5, 2029

Product Category Rule
PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. December 2018.

PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2.0. UL Environment. September 2018. Extended expiration to December 31, 2024.
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Declaration Owner:	KDF Co., Ltd.
Address:	110-3, Sinbong-gil, Yeonginmyeon Asain-is, Chungcheong nam-do, Republic of Korea
Declaration Number:	SCS-EPD-10173
Declaration Validity Period:	EPD Valid June 6, 2024 through June 5, 2029
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell, Ph.D., SCS Global Services
LCA Software and LCI database:	OpenLCA v2.1 software and the Ecoinvent v3.10 database
Product RSL:	10 years
Markets of Applicability:	North America
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Grave
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. December 2018.
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2.0. UL Environment. September 2018.
Part B PCR Review conducted by:	Jack Geibig (chair), Ecoform; Thomas Gloria, Industrial Ecology Consultants; Thaddeus Owen
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Lindita Bushi, Ph.D., Athena Sustainable Materials Institute
Declaration Contents:	1. KDF Co., Ltd. 2 2. Product 2 3. LCA: Calculation Rules 6 4. LCA: Scenarios and Additional Technical Information 12 5. LCA: Results 15 6. LCA: Interpretation 17 7. References 18

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

Comparison of the environmental performance of Flooring Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR.

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1. KDF Co., Ltd.

KDF Unideco, as a global flooring manufacturer, is highly acclaimed at home and abroad by dedicating ourselves to quality control and constant technical development.

We focus on building of:

1. Designs that steal customers' hearts
2. Durable floorings that last with your life
3. Reasonable price to let more people enjoy better homes
4. Floorings that everyone would feel proud of

KDF Unideco promises you the consistent commitment to customer satisfaction and the ceaseless efforts for technical development. Based on building friendly brand images and unparalleled customer services, we will keep moving forward to the best flooring brand in the world.

2. Product

2.1 PRODUCT DESCRIPTION

Product Name	Representative Thickness	Description
Click Tile (5.0mm)	5.0 mm	Unideco's Click'n loc is a 4-sided bevel, which provides a firm, flawless finish to prevent stepping after construction. The durability is enhanced by the top layer of 0.5 mm, and the bonding property is improved by applying the Berlinger 2G profile. It is easy to install because there is no need for special equipment for installation as well as glue. It has excellent dimensional stability due to the use of fiberglass layer, it is strong against deformation due to temperature and humidity, and is suitable for any space.

2.2 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

2.3 APPLICATION

The products provide the primary function of flooring for interior applications. The flooring products are used in various residential and commercial applications including retail, healthcare, education, and hospitality.

2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The life cycle phases included in the product system boundary are shown below.

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards.

Table 1. *Life cycle phases included in the product system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

X = included | MND = Module Not Declared

2.5 TECHNICAL DATA

Technical specifications for the flooring products are summarized in Table 2 and Table 3.

Table 2. *Product characteristics for the **Click Tile (5.0mm)** flooring product.*

Characteristic			Description			
Sustainable certifications			FloorScore (SCS-FS-03081)			
VOC emissions test method			CDPH/EHLB Standard Method V1.2. California Specification 01350			
Characteristic			**Average Value**	**Unit**	**Min Value**	**Max Value**
Product thickness			5.00 (0.20)	mm (in)	4.30 (0.17)	6.00 (0.24)
Wear layer thickness (where applicable)			0.50 (0.02)	mm (in)	0.30 (0.01)	0.70 (0.03)
Product weight			7,840 (25.7)	g/m^2 (oz/ft^2)	8,460 (27.7)	10,420 (34.1)
Product Form	Tiles	Width	169.0 (6.65)	mm (in)	169.0 (6.65)	305.0 (12.0)
		Length	1,210 (48)	mm (in)	610 (24)	1,210 (48)

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Table 3. *Product performance test results for the KDF flooring products.*

Test Description	Test Method	Specification	Test Results
Squareness	ASTM F 2055	≤ 0.25 mm	Pass
Overall Thickness	ISO 24346	± 0.15 mm	Pass
	ASTM F 386	± 0.13 mm	Pass
Thickness of wear layers	ISO 24340	-	Pass
Total mass per unit area	ISO 23997	-	Pass
Dimensional stability and curing after exposure to heat	ISO 23999	≤ 0.4 % (Dimensional stability) ≤ 0.2 mm (Curling)	Pass
Flexibility	ISO 24344	No Crack	Pass
	ASTM F 137	No Crack	Pass
Residual Indentation	ISO 24343-1	≤ 0.1 mm	Pass
Castor chair test	ISO 4918	No damage	Pass
Color fastness to light	ISO 105-B02	≥ 6	Pass
Classification and labeling	ISO 10874	-	Pass
Reaction to fire	ISO 13501-1	Bfl-S1	Pass
Thermal conductivity	EN 12667	< 0.15 (㎡·k)/W	Pass
Anti-slip property	DIN 51130	R10	Pass
Resistance to Chemicals	EN 423	Class 0	Pass
	ASTM F 925	≤ Slight surface change	Pass
Wear resistance	EN 660-2	Wear Group : T	Pass
VOC emission	ISO 16000	A+	Pass
Phthalates	EN 14372	Not detected	Pass
	CPSC-CH-C 1001-09.3	Not detected	Pass

2.6 MARKET PLACEMENT/APPLICATION RULES

Technical specifications of the flooring products are summarized above. Detailed product performance results can be found on the manufacturer's website http://www.ikdf.co.kr.

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The flooring products are delivered for installation in the form of tiles of various dimensions.

2.8 MATERIAL COMPOSITION

The vinyl flooring products (UNSPSC Class Code 30161700/CSI Code 09 65 00) are manufactured at the production facility in Korea. The primary materials include PVC, plasticizers, fillers and stabilizers.

Table 4. *Material content for the flooring products in kg per square meter and percent of total mass.*

Component	(kg/m²)	Percent mass
PVC	3.23	28%
Filler	7.10	62%
Plasticizer	0.848	7.5%
Stabilizer	7.60×10^{-2}	0.67%
Glass Fiber	0.108	0.95%
Pigment/Coating	1.76×10^{-2}	0.15%
Total Product	**11.4**	**100%**

In conformance with the PCR, product materials were reviewed for the presence of any toxic or hazardous chemicals. Based on a review of the product components provided by the manufacturer, no chemicals regulated by the Resource Conservation and Recovery Act (RCRA) were identified in the product or product components. Additionally, there are no releases of such substances associated with the production, use or maintenance of the products.

2.9 MANUFACTURING

The products are manufactured at the production facility in Korea. The manufacturer provided primary data for their annual production, resource use and electricity consumption and waste generation at the facility. Electricity consumption is modeled using Ecoinvent datasets for the regional electricity grid resource mix.

The production of the flooring involves the following general manufacturing processes. The raw materials are first mixed and heated. The mixture is then calendared into a sheet to create the backing or the transparent wear layers. The sheets are cut and laminated with a print film. Finally, the product is cut into tiles and packaged. Quality checks are made at each step of the production process.

2.10 PACKAGING

The products are packaged for shipment using plastic wrap, corrugated board and wooden pallets.

Table 5. *Material content for the flooring product packaging in kg per square meter of flooring.*

Component	(kg/m^2)	Percent mass
Corrugate/Paper	7.04×10^{-2}	30%
Plastic	1.12×10^{-2}	4.8%
Wood	0.152	65%
Total Packaging	**0.233**	**100%**

2.11 PRODUCT INSTALLATION

Installation of the product is accomplished using hand tools with negligible impacts. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements.

2.12 USE CONDITIONS

No special conditions of use are noted.

2.13 REFERENCE SERVICE LIFE

The Reference Service Life (RSL) of the flooring products is 10 years based on the manufacturer's warranted lifetime.

2.14 RE-USE PHASE

The flooring products are not reused at end-of-life.

2.15 DISPOSAL

At end-of-life, the products are disposed of in a landfill.

2.16 FURTHER INFORMATION

Further information on the product can be found on the manufacturer's website http://www.ikdf.co.kr.

3. LCA: Calculation Rules

3.1 FUNCTIONAL UNIT

The functional unit used in the study is defined as 1 m^2 of floor covering installed for use over a 75-year period. The corresponding reference flow for the product system is presented in Table 6. For the present assessment, a reference service lifetime (RSL) corresponding to the manufacturer's warranted lifetime is assumed. The total number of required product lifecycles during the 75-year period over which the product system is modeled is also summarized for the products in Table 6.

Table 6. *Reference flow and RSL for the flooring products.*

Product	Reference Flow (kg/m^2)	Reference Service Lifetime (yr)	Replacement Cycle	Total # of Life Cycles
Click Tile (5.0mm)	11.38	10	6.5	7.5

3.2 SYSTEM BOUNDARY

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The life cycle phases included in the EPD scope are described in Table 7 and illustrated in Figure 1.

Table 7. *The modules and unit processes included in the scope for the flooring product system.*

Module	Module description from the PCR	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Extraction and processing of raw materials for the flooring components.
A2	Transport (to the manufacturer)	Transport of component materials to the manufacturing facility
A3	Manufacturing, including ancillary material production	Manufacturing of flooring products and packaging (incl. upstream unit processes)
A4	Transport (to the building site)	Transport of product (including packaging) to the building site
A5	Construction-installation process	Impacts from the installation of product are assumed negligible. Impacts from the production, transport and disposal of waste material associated with installation are included in this phase in addition to impacts from packaging disposal.
B1	Product use	Use of the flooring in a commercial building setting. There are no associated emissions or impacts from the use of the product
B2	Product maintenance	Maintenance of products over the 75-year ESL, including periodic cleaning.
B3	Product repair	The flooring is not expected to require repair over its lifetime.
B4	Product replacement	The materials and energy required for replacement of the product over the 75-year ESL of the assessment are included in this phase
B5	Product refurbishment	The flooring is not expected to require refurbishment over its lifetime.
B6	Operational energy use by technical building systems	There is no operational energy use associated with the use of the product
B7	Operational water use by technical building systems	There is no operational water use associated with the use of the product
C1	Deconstruction, demolition	Demolition of the product is accomplished using hand tools with no associated emissions and negligible impacts
C2	Transport (to waste processing)	Transport of flooring product to waste treatment at end-of-life
C3	Waste processing for reuse, recovery and/or recycling	The product is disposed of by landfilling which require no waste processing
C4	Disposal	Disposal of flooring product in municipal landfill
D	Reuse-recovery-recycling potential	Module Not Declared

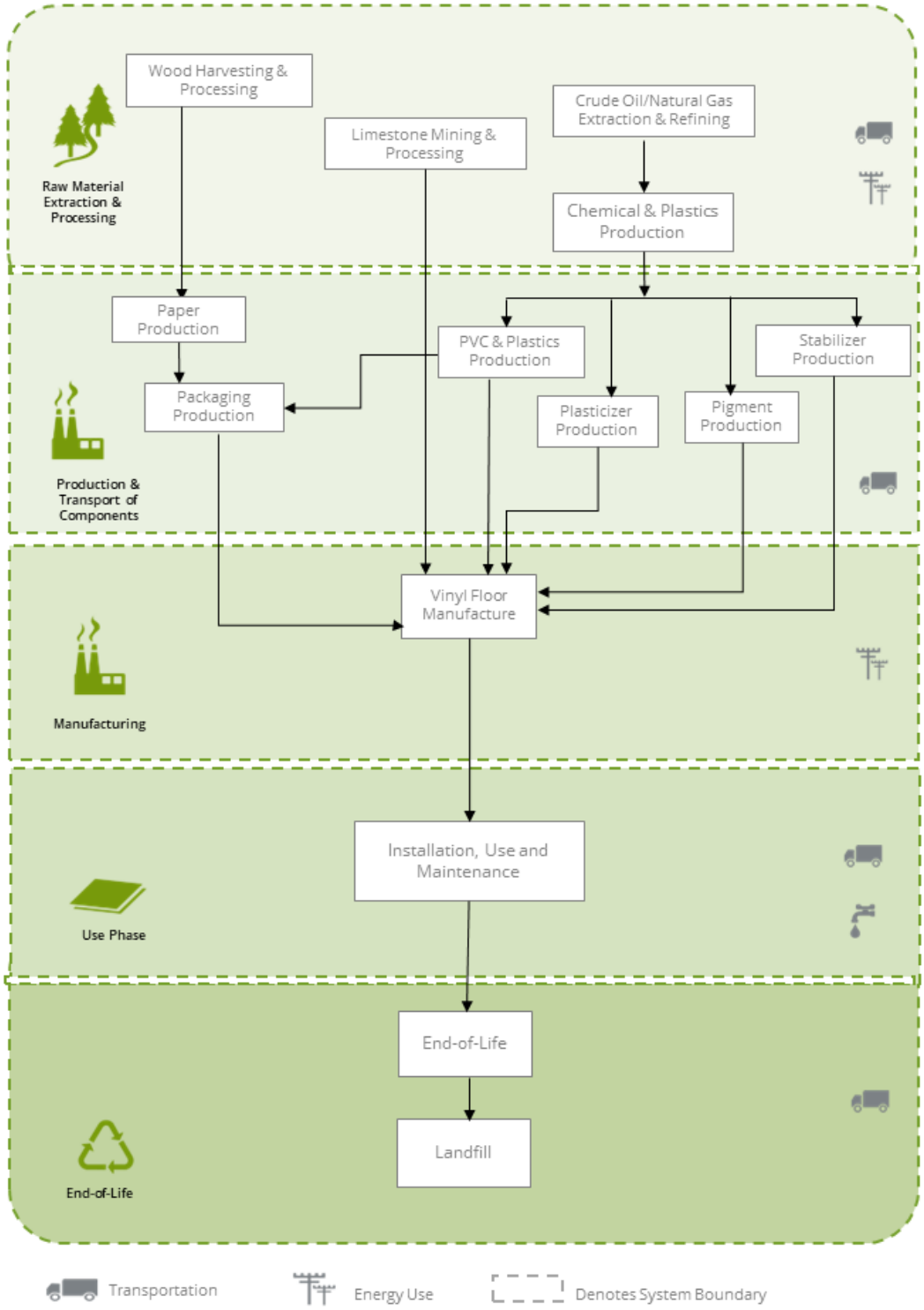

Figure 1. *Flow diagram for the life cycle of the flooring products.*

3.3 PRODUCT SPECIFIC CALCULATION FOR USE PHASE

The recommended cleaning regime is highly dependent on the use of the premises where the floor covering is installed. In high traffic areas more frequent cleaning will be needed compared to areas where there is low traffic. For the purposes of this EPD, average maintenance (moderate traffic levels) is presented based on typical installations.

3.4 UNITS

All data and results are presented using SI units.

3.5 ESTIMATES AND ASSUMPTIONS

- Electricity use at the manufacturing facility was allocated to the products based on the product area as a fraction of the total production.
- The KDF facility under review is located in South Korea. Ecoinvent inventory datasets for the country-specific energy grid were used to model resource use and emissions from electricity use at the manufacturing facilities.
- The Reference Service Life (RSL) of the products was modeled based on information provided by the manufacturer assuming their products are installed and maintained as recommended and used for the specific application noted.
- Downstream transport was modeled based on information provided by the manufacturer representing distribution to consumer markets in North America.
- The maintenance phase of the product life cycle was modeled based on information provided by the manufacturer including recommended installation and cleaning methods, as well as cleaning frequency.
- For the product end-of-life, disposal of product and product packaging is modeled based on the PCR guidance regarding recycling rates of product and packaging materials.
- For final disposal of the packaging material and flooring products at end-of-life, all materials are assumed to be transported 161 km by diesel truck to either a landfill or material reclamation facility (for recycling). Datasets representing disposal in a landfill and waste incineration are from Ecoinvent.
- Inventory data for some material components were unavailable and modeled using proxy datasets from the Ecoinvent LCI databases.

The PCR requires the results for several inventory flows related to construction products to be reported including energy and resource use and waste and outflows. These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted taking into account this limitation.

3.6 CUT-OFF RULES

According to the PCR, processes contributing greater than 5% of the total environmental impact indicator for each impact are included in the inventory. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD.

3.7 DATA SOURCES

Primary data were provided for the manufacturing facility. The sources of secondary LCI data are the Ecoinvent database.

Table 8. *Data sources for the flooring products.*

Component	Dataset	Data Source	Publication Date
PRODUCT			
PVC			
Polyvinyl Chloride	polyvinylchloride production, bulk polymerisation | polyvinylchloride, bulk polymerised | Cutoff, S/RoW; extrusion, co-extrusion of plastic sheets | extrusion, co-extrusion | Cutoff, S/RoW; extrusion, plastic film | extrusion, plastic film | Cutoff, S/RoW	EI v3.10	2023
Filler			
Calcium Carbonate	limestone production, crushed, washed | limestone, crushed, washed | Cutoff, S/RoW	EI v3.10	2023
Plasticizer			
PVC Plasticizer	dioctyl terephthalate production | dioctyl terephthalate | Cutoff, S/GLO	EI v3.10	2023
Stabilizer			
Stabilizer	market for chemical, organic | chemical, organic | Cutoff, S/GLO	EI v3.10	2023
	market for chemicals, inorganic | chemical, inorganic | Cutoff, S/GLO	EI v3.10	2023
	barium carbonate production | barium carbonate | Cutoff, S/GLO	EI v3.10	2023
	market for zinc oxide | zinc oxide | Cutoff, S/GLO	EI v3.10	2023
Pigments			
Carbon Black	market for carbon black | carbon black | Cutoff, S/GLO	EI v3.10	2023
Other			
Glass fibre	glass fibre production | glass fibre | Cutoff, S/RoW	EI v3.10	2023
Coating	market for chemical, organic | chemical, organic | Cutoff, S/GLO	EI v3.10	2023
PACKAGING			
Cardboard/Paper	corrugated board box production | corrugated board box | Cutoff, S/RoW; containerboard production, linerboard, testliner | containerboard, linerboard | Cutoff, S/RoW	EI v3.10	2023
Wrapping film	packaging film production, low density polyethylene | packaging film, low density polyethylene | Cutoff, S/RoW	EI v3.10	2023
Plastics	polypropylene production, granulate | polypropylene, granulate | Cutoff, S/RoW	EI v3.10	2023
Wood	EUR-flat pallet production | EUR-flat pallet | Cutoff, S/RoW	EI v3.10	2023
TRANSPORT			
Road transport	market for transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, S/RoW	EI v3.10	2023
Ship transport	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, S/GLO	EI v3.10	2023
MAINTENANCE			
Neutral cleaner	ethoxylated alcohol (AE7) production, petrochemical | ethoxylated alcohol (AE7) | Cutoff, S/RoW; fatty acid production, from palm oil | fatty acid | Cutoff, S/RoW; tap water production, conventional treatment | tap water | Cutoff, S/RoW	EI v3.10	2023
Electricity	market for electricity, low voltage | electricity, low voltage | Cutoff, S/US	EI v3.10	2023
Water	tap water production, conventional treatment | tap water | Cutoff, S/RoW	EI v3.10	2023
WASTE DISPOSAL			
Landfill	treatment of municipal solid waste, sanitary landfill | municipal solid waste | Cutoff, S/RoW	EI v3.10	2023
	treatment of waste polyvinylchloride, sanitary landfill | waste polyvinylchloride | Cutoff, S/RoW	EI v3.10	2023
RESOURCES			
Grid electricity - Korea	market for electricity, medium voltage | electricity, medium voltage | Cutoff, S/KR	EI v3.10	2023
Heat – natural gas	market for heat, central or small-scale, natural gas | heat, central or small-scale, natural gas | Cutoff, S/RoW	EI v3.10	2023
Water	tap water production, conventional treatment | tap water | Cutoff, S/RoW	EI v3.10	2023

3.8 DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 9. *Data quality assessment for the flooring product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old. All of the data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annual production for 2022-23.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative data for South Korea. Surrogate data used in the assessment are representative of global or European operations. Data representative of European operations is considered sufficiently similar to actual processes. Data representing product disposal are based on regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative fabrication datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the flooring products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.10 data where available. Different portions of the product life cycle are equally considered.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the manufacturing facility represents an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.10 LCI data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations were not available and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.9 PERIOD UNDER REVIEW

The LCA results are based on annualized production data for November 2022 through October 2023.

3.10 ALLOCATION

Manufacturing resource use was allocated to the products based on surface area. Impacts from transportation were modeled based on the mass of material and distance transported.

3.11 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

4. LCA: Scenarios and Additional Technical Information

Delivery and Installation stage (A4 - A5)

Distribution of the flooring products to the point of sale is included, based on data from the manufacturer. Average transport distances for distribution of the products from the manufacturing facilities to distribution centers in North America were provided by the manufacturer. Transport by diesel truck from the distribution centers to the point of installation is also included, based on information provided by the manufacturer. Transportation parameters for modeling product distribution are summarized in Table 10.

Table 10. *Product distribution parameters by transport mode.*

Parameter	Unit	Value
Fuel type	-	Diesel
Liters of fuel	L/100km	18.7
Vehicle type	-	Diesel truck
Transport distance	km	800
Capacity utilization	%	76
Gross density of products transported	kg/m^3	2,324
Weight of products transported	kg	11.62
Fuel type	-	Fuel oil
Liters of fuel	L/tkm	2.23
Vehicle type	-	Ocean freighter
Transport distance	km	10,978
Capacity utilization	%	70
Gross density of products transported	kg/m^3	2,324
Weight of products transported	kg	11.62

Installation of the product is accomplished using hand tools with no associated emissions and negligible impacts. Approximately 4% installation waste is assumed landfilled. The impacts associated with packaging disposal, as well as the production, transport and disposal of installation waste are included with the installation phase as per PCR requirements. The VOC emissions associated with the installation, use and maintenance of the products are negligible. Modeling parameters for product installation are summarized in Table 11.

Table 11. *Installation parameters for the flooring products, per 1 m^2.*

Parameter		Value
Ancillary materials		0.00
Net freshwater consumption (m^3)		0.00
Electricity consumption (kWh)		0.00
Product loss per functional unit (kg)		0.455
Waste materials generated by product installation (kg)		0.688
Output materials resulting from on-site waste processing (kg)		n/a
Mass of packaging waste (kg)	Plastic	1.12×10^{-2}
	Corrugate	7.04×10^{-2}
	Wood	0.152
Biogenic carbon contained in packaging (kg CO_2)		0.407
Direct emissions (kg)		0.00

Use stage (B1)

No impacts are associated with the use of the product over the Reference Service Lifetime.

Maintenance stage (B2)

According to the manufacturer, typical maintenance involves regular sweeping and damp mopping, as well as periodic machine cleaning of the vinyl flooring. The present assessment is based on a recommended weekly cleaning schedule including sweeping and mopping with a neutral cleaner and monthly machine cleaning. The parameters used to model the product maintenance are summarized in Table 12.

Table 12. *Maintenance parameters for the flooring products, per 1 m^2.*

Parameter	Unit	Click Tile
Maintenance cycle	Cycles / RSL	520
Maintenance cycle	Cycles / ESL	3,900
Maintenance process	-	Damp mopping
Net freshwater consumption	$m^3/m^2/yr$	0.0058
Cleaning agent	$kg/m^2/yr$	0.0119
Maintenance process	-	Machine cleaning
Electricity	$kWh/m^2/yr$	0.022
Further assumptions	-	Moderate traffic; weekly maintenance

Repair/Refurbishment stage (B3; B5)

Product repair and refurbishment are not relevant during the lifetime of the product.

Replacement stage (B4)

The materials and energy required for replacement of the product over the 75-year estimated service lifetime of the assessment are included in this stage. Modeling parameters for the product replacement stage are summarized in Table 13.

Table 13. *Product replacement parameters for the flooring products, per 1 m^2.*

Parameter	Value	Units
Reference service life	10	Years
Replacement cycle	6.5	-
Energy input	-	kWh
Freshwater consumption	-	m^3
Ancillary materials	-	kg
Replacement parts	75.5	kg
Direct emissions	-	kg

Building operation stage (B6 – B7)

There is no operational energy or water use associated with the use of the product.

Disposal stage (C1 - C4)

At end-of-life, the product is assumed to be disposed in a landfill per PCR guidance. Assumptions for end-of-life for the packaging are based on regional statistics regarding municipal solid waste generation and disposal, including end-of-life recycling rates of packaging and product materials.

Transportation of waste materials at end-of-life (*C2*) assumes a 161 km (~100 miles) average distance to disposal. No recycling of the product materials is assumed at end-of-life. The relevant disposal parameters used for the product system are summarized in Table 14.

Table 14. *End-of-life disposal scenario parameters for the flooring product.*

Parameter	Value
Assumptions for scenario development	100% landfill
Collection process	
Collected with mixed construction waste (kg)	11.38
Recovery	n/a
Landfill disposal (kg)	11.38
Removals of biogenic carbon (kg CO_2 eq)[1]	n/a

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All LCA results are stated to three significant figures in agreement with the PCR for this flooring product and therefore the sum of the total values may not exactly equal 100%.

The following environmental impact category indicators are reported using characterization factors based on the U.S. EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts – TRACI 2.1 and CML-IA.

CMLI-A Impact Category	Unit	TRACI 2.1 Impact Category	Unit
Global Warming Potential **(GWP)**	kg CO_2 eq	Global Warming Potential **(GWP)**	kg CO_2 eq
Depletion potential of the stratospheric ozone layer **(ODP)**	kg CFC 11 eq	Ozone Depletion Potential **(ODP)**	kg CFC 11 eq
Acidification Potential of soil and water **(AP)**	kg SO_2 eq	Acidification Potential **(AP)**	kg SO_2 eq
Eutrophication Potential **(EP)**	kg PO_4^{3-} eq	Eutrophication Potential **(EP)**	kg N eq
Photochemical Oxidant Creation Potential **(POCP)**	kg C_2H_4 eq	Smog Formation Potential **(SFP)**	kg O_3 eq
Abiotic depletion potential **(ADP-elements)** for non-fossil resources	kg Sb eq	Fossil Fuel Depletion Potential **(ADP_{fossil})**	MJ Surplus, LHV
Abiotic depletion potential **(ADP-fossil fuels)** for fossil resources	MJ, LHV		

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The following inventory parameters, specified by the PCR, are also reported.

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**HLRW:** High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	**ILLRW:** Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	MJ, LHV	**CRU:** Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	**MR:** Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	**MER:** Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	**EE:** Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Modules B1, B3, B5, B6 and B7 are not associated with any impact and are therefore declared as zero. In addition, module C1 is likewise not associated with any impact as the floor is manually deconstructed. Additionally, as the flooring products do not typically contain significant amounts of bio-based materials, biogenic carbon emissions and removals are not declared. Module D is not declared. In the interest of space and table readability, these modules are not included in the results presented below.

Table 15. *Life Cycle Impact Assessment results for the flooring products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.* ***(Click Tile (5.0mm))***

Impact Category	A1	A2	A3	A4	A5	B2	B4	C2	C4
CML									
GWP (kg CO_2 eq)	17.3	0.593	11.6	3.09	1.71	4.63	271	2.54	4.79
	5.5%	0.19%	3.7%	0.98%	0.54%	1.5%	85%	0.8%	1.5%
AP (kg SO_2 eq)	$5.90x10^{-2}$	$1.86x10^{-3}$	$1.00x10^{-2}$	$3.63x10^{-2}$	$4.57x10^{-3}$	$1.71x10^{-2}$	0.797	$9.66x10^{-3}$	$1.25x10^{-3}$
	6.3%	0.2%	1.1%	3.9%	0.49%	1.8%	85%	1%	0.13%
EP (kg $(PO_4)^{3-}$ eq)	$2.50x10^{-2}$	$5.13x10^{-4}$	$2.30x10^{-2}$	$4.99x10^{-3}$	$7.86x10^{-3}$	$1.20x10^{-2}$	1.06	$2.22x10^{-3}$	$9.93x10^{-2}$
	2%	0.042%	1.9%	0.4%	0.64%	0.97%	86%	0.18%	8.1%
POCP (kg C_2H_4 eq)	$6.64x10^{-3}$	$9.12x10^{-5}$	$1.23x10^{-3}$	$1.11x10^{-3}$	$4.48x10^{-4}$	$9.71x10^{-4}$	$7.13x10^{-2}$	$4.31x10^{-4}$	$1.02x10^{-3}$
	8%	0.11%	1.5%	1.3%	0.54%	1.2%	86%	0.52%	1.2%
ODP (kg CFC-11 eq)	$8.55x10^{-6}$	$7.08x10^{-9}$	$1.30x10^{-7}$	$3.63x10^{-8}$	$3.50x10^{-7}$	$6.04x10^{-8}$	$5.92x10^{-5}$	$3.11x10^{-8}$	$2.99x10^{-9}$
	13%	0.01%	0.19%	0.053%	0.51%	0.088%	87%	0.045%	0.0044%
ADPF (MJ eq)	319	8.25	151	40.7	21.7	79.7	3,750	32.8	3.29
	7.2%	0.19%	3.4%	0.92%	0.49%	1.8%	85%	0.74%	0.075%
ADPE (kg Sb eq)	$8.31x10^{-5}$	$8.46x10^{-7}$	$4.10x10^{-6}$	$3.07x10^{-6}$	$3.67x10^{-6}$	$1.07x10^{-5}$	$6.22x10^{-4}$	$7.84x10^{-7}$	$1.53x10^{-7}$
	11%	0.12%	0.56%	0.42%	0.5%	1.5%	85%	0.11%	0.021%
TRACI									
GWP (kg CO_2 eq)	17.1	0.588	11.3	3.07	1.62	4.58	260	2.53	3.90
	5.6%	0.19%	3.7%	1%	0.53%	1.5%	85%	0.83%	1.3%
AP (kg SO_2 eq)	$6.47x10^{-2}$	$2.24x10^{-3}$	$1.13x10^{-2}$	$3.94x10^{-2}$	$5.07x10^{-3}$	$1.82x10^{-2}$	0.891	$1.23x10^{-2}$	$2.09x10^{-3}$
	6.2%	0.21%	1.1%	3.8%	0.48%	1.7%	85%	1.2%	0.2%
EP (kg N eq)	$5.13x10^{-2}$	$6.11x10^{-4}$	$5.86x10^{-2}$	$3.43x10^{-3}$	$2.02x10^{-2}$	$2.62x10^{-2}$	2.66	$1.26x10^{-3}$	0.274
	1.7%	0.02%	1.9%	0.11%	0.65%	0.85%	86%	0.041%	8.8%
SFP (kg O_3 eq)	0.869	$5.70x10^{-2}$	0.222	0.779	$8.66x10^{-2}$	0.215	15.7	0.372	$2.57x10^{-2}$
	4.7%	0.31%	1.2%	4.3%	0.47%	1.2%	86%	2%	0.14%
ODP (kg CFC-11 eq)	$1.05x10^{-5}$	$9.63x10^{-9}$	$1.77x10^{-7}$	$4.90x10^{-8}$	$4.30x10^{-7}$	$8.84x10^{-8}$	$7.27x10^{-5}$	$4.17x10^{-8}$	$4.18x10^{-9}$
	12%	0.011%	0.21%	0.058%	0.51%	0.11%	87%	0.05%	0.005%
FFD (MJ eq)	41.2	1.17	23.5	5.87	3.00	9.09	521	4.94	0.445
	6.8%	0.19%	3.9%	0.96%	0.49%	1.5%	85%	0.81%	0.073%

Table 16. *Resource use and waste flows for the flooring products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.* ***(Click Tile (5.0mm))***

Parameter	A1	A2	A3	A4	A5	B2	B4	C2	C4
Resources									
RPR_E (MJ)	15.7	0.111	8.84	0.453	1.01	4.49	171	0.143	$9.34x10^{-2}$
	7.8%	0.055%	4.4%	0.22%	0.5%	2.2%	85%	0.071%	0.046%
RPR_M (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0%	0%	0%	0%	0%	0%	0%	0%	0%
$NRPR_E$ (MJ)	275	8.36	158	41.1	22.7	82.0	3,920	33.0	3.41
	6.1%	0.18%	3.5%	0.91%	0.5%	1.8%	86%	0.73%	0.075%
$NRPR_M$ (MJ)	61.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	100%	0%	0%	0%	0%	0%	0%	0%	0%
SM (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF/NRSF (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RE (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW (m^3)	1.28	$6.71x10^{-3}$	0.137	$2.70x10^{-2}$	$5.86x10^{-2}$	0.775	9.93	$1.23x10^{-2}$	$5.61x10^{-3}$
	10%	0.055%	1.1%	0.22%	0.48%	6.3%	81%	0.1%	0.046%
Wastes									
HWD (kg)	$5.68x10^{-3}$	$5.82x10^{-5}$	$7.90x10^{-4}$	$2.58x10^{-4}$	$2.78x10^{-4}$	$9.78x10^{-4}$	$4.76x10^{-2}$	$2.31x10^{-4}$	$2.20x10^{-5}$
	10%	0.1%	1.4%	0.46%	0.5%	1.8%	85%	0.41%	0.039%
NHWD (kg)	1.34	0.397	2.40	1.22	0.885	0.169	116	0.157	11.4
	1%	0.3%	1.8%	0.91%	0.66%	0.13%	87%	0.12%	8.5%
HLRW (kg)	$7.15x10^{-5}$	$5.04x10^{-7}$	$3.49x10^{-5}$	$2.04x10^{-6}$	$4.41x10^{-6}$	$1.10x10^{-5}$	$7.45x10^{-4}$	$7.45x10^{-7}$	$5.07x10^{-7}$
	8.2%	0.058%	4%	0.23%	0.51%	1.3%	86%	0.086%	0.058%
ILLRW (kg)	$1.89x10^{-4}$	$1.19x10^{-6}$	$6.18x10^{-5}$	$4.84x10^{-6}$	$1.04x10^{-5}$	$2.52x10^{-5}$	$1.76x10^{-3}$	$1.75x10^{-6}$	$1.28x10^{-6}$
	9.2%	0.058%	3%	0.24%	0.51%	1.2%	86%	0.085%	0.062%
CRU (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MR (kg)	0.00	0.00	0.00	0.00	$2.33x10^{-2}$	0.00	0.151	0.00	0.00
	0%	0%	0%	0%	13%	0%	87%	0%	0%
MER (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

6. LCA: Interpretation

The contributions to total impact indicator results are dominated by the product replacement phase (B4) of the assessment. Of the remaining life cycle phases, with few exceptions, the raw material extraction and processing (A1) and product maintenance (B2) phases are the largest contributors to indicator impact results followed by product distribution (A4) and product manufacture (A3). Other life cycle phase contributions are minimal.

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