

**Declaration Owner****Daejin Co., Ltd.**

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Product

Acoustic Tile (5.0mm)

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

Functional Unit

The functional unit is one square meter of flooring over a 75-year period

EPD Number and Period of Validity

SCS-EPD-09983

EPD Valid March 6, 2024 through March 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.

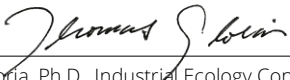
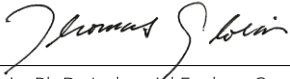
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Address:	176-10, Yeonamyulgeum-ro, Eumbong-myeon, Asan-si, Republic of Korea
Declaration Number:	SCS-EPD-09983
Declaration Validity Period:	EPD Valid March 6, 2024 through March 5, 2029
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell, Ph.D., SCS Global Services
LCA Software and LCI database:	OpenLCA v1.11 software and the Ecoinvent v3.9 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:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants
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:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	1. Daejin Co., Ltd. 2 2. Product 2 3. LCA: Calculation Rules 6 4. LCA: Scenarios and Additional Technical Information 11 5. LCA: Results 14 6. LCA: Interpretation 16 7. References 17
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. 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. Daejin Co., Ltd.

The leading PVC flooring tiles manufacturer in Korea, Daejin Co., Ltd. has been growing up for over 30 years with the brand name of DECORIA, through the efforts of endless quality control and renovation of production. We, DECORIA, are supplying the stable quality products to our clients with the systems approved by ISO 9001, 14001, JIS, CE, KS and trying hard to satisfy our clients with the most competitive price that we could achieve by our own production know-how over 30 years and with the revolutionary new designs. And we are leading international markets in USA, EU and many other countries by supplying newly developed eco-friendly click products and loose-lay tiles which you don't need adhesives for installation.

We promise that our endeavors won't be stopped in the future as well and will do our utmost with the belief that our clients' love and trust is the ultimate value that we have to pursue at all times.

We expect your continuous attention and support.

2. Product

2.1 PRODUCT DESCRIPTION

Product Name	Representative Thickness (mm)	Description
Acoustic Tile (5.0mm))	5.0 mm	Style your home with the natural elegance of wood specialized technology of "Acoustic" function. Sounds can be stressful in our environment, so DECORIA Acoustic is the key when it comes to reduce the noise between the stories in any residential places.

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 **Acoustic Tile (5.0mm)** flooring product.

Characteristic		Description			
Sustainable certifications		FloorScore (SCS-FS-03041)			
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)	4.90 (0.19)	5.10 (0.20)
Wear layer thickness (where applicable)		0.50 (0.02)	mm (in)	0.30 (0.01)	0.50 (0.02)
Product weight		7,842 (25.7)	g/m ² (oz/ft ²)	7,381 (24.2)	8,304 (27.2)
Product Form	Tiles	Width	177.8 (7.00)	mm (in)	152.4 (6.00)
		Length	1.22 (4.00)	m (ft)	0.91 (3.00)

Table 3. Product performance test results for the Daejin flooring products.

Test Description	Test Method	Specification	Test Results
Squareness	ISO 24342	≤0.25mm	Pass
Overall thickness	ISO 24346	±0.15mm	Pass
Thickness of wear layer	EN ISO 10582 ISO 24340	-	Pass
Total mass per unit area	EN ISO 10582 ISO 23997	-10%,+13%	Pass
Dimensional stability and curling after exposure to heat	ISO 23999	≤0.25 % (tiles intended for dry-joint laying) ≤0.4 % (sheets and tiles intended for heat welding)	Pass
Residual indentation	ISO 24343	≤ 0.1 mm	Pass
Colour fastness to artificial light	ISO 105-B02 ASTM F1515-15	> Grade 6	Pass
Reaction to fire	EN 13501-1	≥8.0 kW/m ²	Bfl - S1
Wear resistance	EN 660-2	2.0 < Fv < 4.0	Group P
Impact Sound Transmission	ASTM E492-09	-	Pass
Castor chair	ISO 4918:2016	No damage	Pass
Resistance to scratching	EN 438-2:2016	-	Pass
Resistance to light	ASTM F1515-15	-	Pass
Flexibility	ISO 24344	No cracking	No cracking
Seam strength	EN ISO 10582	Product don't need to be welled when installed.	NA
Identification	EN ISO 10582	Type 1: Wear-layer binder content > 80 %	Type 1
Classification	EN ISO 10582	-	Pass
Color difference	ASTM F 1514	CIE-D65	ΔE*ab=3.3
Contents of Pentachlorophenol	BS 5666 part.6	Not detected	Pass
Emission of Formaldehyde	EN 14041	Not detected	Pass
Smoke	ASTM E662	-	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.decoria.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 30161707) 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/m ²	Percent mass
PVC	3.06	39%
Filler	3.82	49%
Plasticizer	0.409	5.2%
Stabilizer	2.05x10 ⁻²	0.26%
Glass Fiber	0.522	6.7%
Pigment	1.02x10 ⁻²	0.13%
Total Product	7.84	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 regulated chemicals, i.e., substances of Very High Concern (SVHC) or substances on the REACH Candidate List, were identified in the product or product components.

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 planks 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
Corrugated	0.302	36%
Plastic	6.92x10 ⁻²	8.3%
Wood	0.462	55%
Total Packaging	0.833	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 varies 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.decoria.co.kr/>.

3. LCA: Calculation Rules

3.1 FUNCTIONAL UNIT

The functional unit used in the study is defined as 1 m² 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
Acoustic Tile (5.0mm)	8.67	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 (including 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

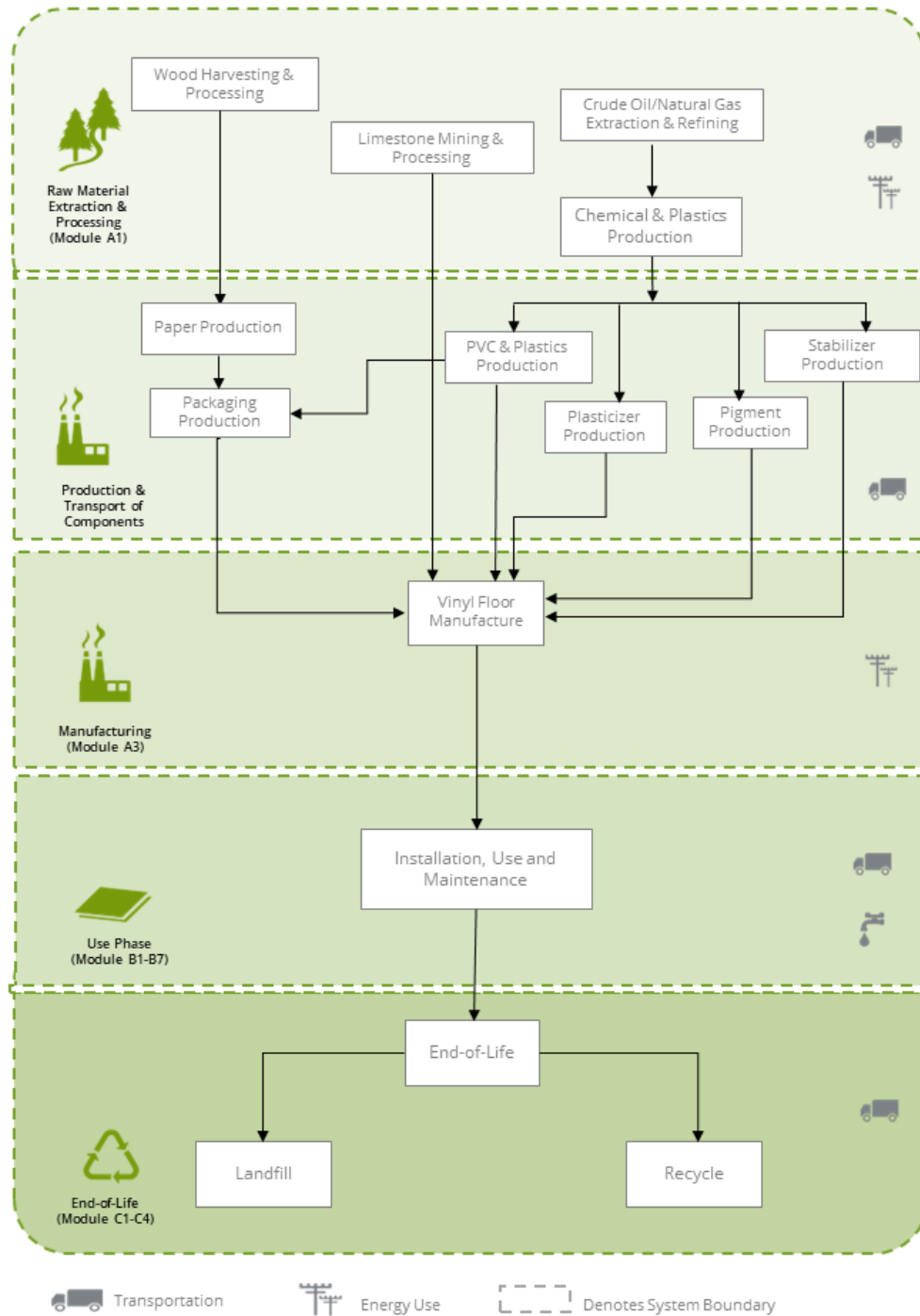


Figure 1. Flow diagram for the life cycle of the flooring products.

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 Daejin facility under review is located in Korea. An Ecoinvent inventory dataset for the country-specific energy grid was used to model resource use and emissions from electricity use at the manufacturing facility.
- 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.
- Inventory data for some material components were unavailable and modeled using proxy datasets from the Ecoinvent LCI databases.
- The maintenance phase of the product life cycle was modeled based on information provided by the manufacturers 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 regional statistics 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.

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 v3.9	2022
Recycled PVC	polyvinylchloride production, bulk polymerisation polyvinylchloride, bulk polymerised Cutoff, S/RoW; market for waste polyethylene, for recycling, sorted waste polyethylene, for recycling, sorted Cutoff, S/RoW; extrusion, plastic pipes extrusion, plastic pipes Cutoff, S/RoW	EI v3.9	2022
Filler			
Calcium Carbonate	limestone production, crushed, washed limestone, crushed, washed Cutoff, S/RoW	EI v3.9	2022
Plasticizer			
PVC Plasticizer	diethyl terephthalate production diethyl terephthalate Cutoff, S/GLO	EI v3.9	2022
Stabilizer			
Stabilizer	market for chemical, organic chemical, organic Cutoff, S/GLO	EI v3.9	2022
	market for chemicals, inorganic chemical, inorganic Cutoff, S/GLO	EI v3.9	2022
	barium carbonate production barium carbonate Cutoff, S/GLO	EI v3.9	2022
	market for zinc oxide zinc oxide Cutoff, S/GLO	EI v3.9	2022
Other			
Carbon Black	market for carbon black carbon black Cutoff, S/GLO	EI v3.9	2022
Glass fibre	glass fibre production glass fibre Cutoff, S/RoW	EI v3.9	2022
Adhesive	polyurethane adhesive production polyurethane adhesive Cutoff, S/GLO	EI v3.9	2022
PACKAGING			
Cardboard/Paper	corrugated board box production corrugated board box Cutoff, S/RoW; containerboard production, linerboard, testliner containerboard, linerboard Cutoff, S/RoW	EI v3.9	2022
Wrapping film	packaging film production, low density polyethylene packaging film, low density polyethylene Cutoff, S/RoW	EI v3.9	2022
Plastics	polypropylene production, granulate polypropylene, granulate Cutoff, S/RoW	EI v3.9	2022
Wood	EUR-flat pallet production EUR-flat pallet Cutoff, S/RoW	EI v3.9	2022
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 v3.9	2022
Rail transport	transport, freight train, diesel transport, freight train Cutoff, S/RoW	EI v3.9	2022
Ship transport	transport, freight, sea, container ship transport, freight, sea, container ship Cutoff, S/GLO	EI v3.9	2022
RESOURCES			
Grid electricity - Korea	market for electricity, medium voltage electricity, medium voltage Cutoff, S/KR	EI v3.9	2022
Heat - natural gas	market for heat, central or small-scale, natural gas heat, central or small-scale, natural gas Cutoff, S/RoW	EI v3.9	2022
Heat - light fuel oil	light fuel oil, at industrial furnace 1MW heat, district or industrial, other than natural gas Cutoff, S/RoW	EI v3.9	2022
Heat - LPG	propane, burned in building machine propane, burned in building machine Cutoff, S/GLO	EI v3.9	2022

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 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 v3.9 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 v3.9 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 October 2022 through September 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	888
Capacity utilization	%	76
Weight of products transported	kg	8.67
Fuel type	-	Diesel
Liters of fuel	L/tkm	9.01
Vehicle type	-	Diesel train
Transport distance	km	340
Capacity utilization	%	7
Weight of products transported	kg	8.67
Fuel type	-	Fuel oil
Liters of fuel	L/tkm	2.23
Vehicle type	-	Ocean freighter
Transport distance	km	18,000
Capacity utilization	%	70
Weight of products transported	kg	8.67

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. Modeling parameters for product installation are summarized in Table 11.

Table 11. *Installation parameters for the flooring products, per 1 m².*

Parameter		Acoustic Tile (5.0mm)
Ancillary materials		0.00
Net freshwater consumption (m ³)		0.00
Electricity consumption (kWh)		0.00
Product loss per functional unit (kg)		0.314
Waste materials generated by product installation (kg)		1.12
Output materials resulting from on-site waste processing (kg)		n/a
Mass of packaging waste (kg)	Plastic	4.06x10 ⁻²
	Corrugate	0.302
	Wood	0.462
Biogenic carbon contained in packaging (kg CO ₂)		1.40
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 m².*

Parameter	Unit	Value
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 m².*

Parameter	Value	Units
Reference service life	10	Years
Replacement cycle	6.5	-
Energy input	-	kWh
Freshwater consumption	-	m ³
Ancillary materials	-	kg
Replacement parts	56.4	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)	7.84
Recovery	n/a
Landfill disposal (kg)	7.84
Removals of biogenic carbon (kg CO ₂ eq)	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.

CML-IA 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 ₂ H 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. **(Acoustic Tile (5.0mm))**

Impact Category	A1	A2	A3	A4	A5	B2	B4	C2	C4
CML									
GWP (kg CO ₂ eq)	10.2	0.207	3.04	3.22	1.53	3.95	151	1.74	3.23
	5.7%	0.12%	1.7%	1.8%	0.86%	2.2%	85%	0.98%	1.8%
AP (kg SO ₂ eq)	4.24x10 ⁻²	6.84x10 ⁻⁴	7.16x10 ⁻³	4.38x10 ⁻²	4.65x10 ⁻³	1.64x10 ⁻²	0.692	6.87x10 ⁻³	8.48x10 ⁻⁴
	5.2%	0.084%	0.88%	5.4%	0.57%	2%	85%	0.84%	0.1%
EP (kg (PO ₄) ³⁻ eq)	1.65x10 ⁻²	1.73x10 ⁻⁴	6.53x10 ⁻³	5.77x10 ⁻³	4.18x10 ⁻³	1.07x10 ⁻²	0.362	1.55x10 ⁻³	2.10x10 ⁻²
	3.9%	0.04%	1.5%	1.3%	0.98%	2.5%	85%	0.36%	4.9%
POCP (kg C ₂ H ₄ eq)	3.39x10 ⁻³	3.30x10 ⁻⁵	5.26x10 ⁻⁴	1.30x10 ⁻³	3.88x10 ⁻⁴	8.13x10 ⁻⁴	4.31x10 ⁻²	2.98x10 ⁻⁴	6.89x10 ⁻⁴
	6.7%	0.065%	1%	2.6%	0.77%	1.6%	85%	0.59%	1.4%
ODP (kg CFC-11 eq)	4.33x10 ⁻⁶	2.74x10 ⁻⁹	3.71x10 ⁻⁸	4.10x10 ⁻⁸	1.79x10 ⁻⁷	2.10x10 ⁻⁸	3.00x10 ⁻⁵	2.19x10 ⁻⁸	2.13x10 ⁻⁹
	13%	0.0079%	0.11%	0.12%	0.52%	0.061%	87%	0.063%	0.0062%
ADPF (MJ eq)	177	2.90	35.9	42.0	13.1	75.9	1,920	22.6	2.31
	7.7%	0.13%	1.6%	1.8%	0.57%	3.3%	84%	0.98%	0.1%
ADPE (kg Sb eq)	2.23x10 ⁻⁴	6.68x10 ⁻⁷	4.84x10 ⁻⁶	6.64x10 ⁻⁶	9.57x10 ⁻⁶	2.58x10 ⁻⁵	1.60x10 ⁻³	1.12x10 ⁻⁶	3.75x10 ⁻⁷
	12%	0.036%	0.26%	0.36%	0.51%	1.4%	85%	0.06%	0.02%
TRACI									
GWP (kg CO ₂ eq)	10.1	0.205	2.95	3.20	1.38	3.92	144	1.73	2.63
	5.9%	0.12%	1.7%	1.9%	0.81%	2.3%	85%	1%	1.5%
AP (kg SO ₂ eq)	4.42x10 ⁻²	8.17x10 ⁻⁴	8.37x10 ⁻³	4.75x10 ⁻²	5.17x10 ⁻³	1.66x10 ⁻²	0.756	8.72x10 ⁻³	1.52x10 ⁻³
	5%	0.092%	0.94%	5.3%	0.58%	1.9%	85%	0.98%	0.17%
EP (kg N eq)	3.38x10 ⁻²	1.94x10 ⁻⁴	1.41x10 ⁻²	3.58x10 ⁻³	9.88x10 ⁻³	2.32x10 ⁻²	0.775	9.14x10 ⁻⁴	5.68x10 ⁻²
	3.7%	0.021%	1.5%	0.39%	1.1%	2.5%	84%	0.1%	6.2%
SFP (kg O ₃ eq)	0.625	2.06x10 ⁻²	0.157	0.941	0.101	0.202	13.8	0.261	1.88x10 ⁻²
	3.9%	0.13%	0.97%	5.8%	0.63%	1.3%	86%	1.6%	0.12%
ODP (kg CFC-11 eq)	5.11x10 ⁻⁶	3.61x10 ⁻⁹	5.72x10 ⁻⁸	5.40x10 ⁻⁸	2.13x10 ⁻⁷	3.36x10 ⁻⁸	3.56x10 ⁻⁵	2.91x10 ⁻⁸	2.93x10 ⁻⁹
	12%	0.0088%	0.14%	0.13%	0.52%	0.082%	87%	0.071%	0.0071%
FFD (MJ eq)	22.1	0.412	3.98	6.07	1.72	8.84	247	3.41	0.301
	7.5%	0.14%	1.4%	2.1%	0.59%	3%	84%	1.2%	0.1%

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. **(Acoustic Tile (5.0mm))**

Parameter	A1	A2	A3	A4	A5	B2	B4	C2	C4
Resources									
RPR _E (MJ)	11.0	3.74x10 ⁻²	19.1	0.462	1.25	3.50	208	8.94x10 ⁻²	9.14x10 ⁻²
	4.5%	0.015%	7.8%	0.19%	0.51%	1.4%	85%	0.037%	0.038%
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)	INA	INA	INA	INA	INA	INA	INA	INA	INA
NRPR _M (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	INA
SM (kg)	1.10	0.00	0.00	0.00	0.00	0.00	7.12	0.00	0.00
	13%	0%	0%	0%	0%	0%	87%	0%	0%
RSF/NRSF (MJ)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
RE (MJ)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
FW (m ³)	0.709	2.24x10 ⁻³	0.163	2.64x10 ⁻²	3.76x10 ⁻²	0.681	6.18	8.08x10 ⁻³	4.50x10 ⁻³
	9.1%	0.029%	2.1%	0.34%	0.48%	8.7%	79%	0.1%	0.058%
Wastes									
HWD (kg)	3.63x10 ⁻⁴	1.90x10 ⁻⁵	1.01x10 ⁻⁴	2.45x10 ⁻⁴	4.78x10 ⁻⁵	6.29x10 ⁻⁵	6.13x10 ⁻³	1.54x10 ⁻⁴	1.41x10 ⁻⁵
	5.1%	0.27%	1.4%	3.4%	0.67%	0.88%	86%	2.2%	0.2%
NHWD (kg)	1.33	0.143	0.740	1.09	1.21	0.244	81.2	0.115	7.86
	1.4%	0.15%	0.79%	1.2%	1.3%	0.26%	86%	0.12%	8.4%
HLRW (kg)	4.83x10 ⁻⁵	1.76x10 ⁻⁷	4.27x10 ⁻⁵	2.11x10 ⁻⁶	3.86x10 ⁻⁶	7.15x10 ⁻⁶	6.38x10 ⁻⁴	4.92x10 ⁻⁷	4.88x10 ⁻⁷
	6.5%	0.024%	5.7%	0.28%	0.52%	0.96%	86%	0.066%	0.066%
ILLRW (kg)	1.23x10 ⁻⁴	4.18x10 ⁻⁷	7.44x10 ⁻⁵	5.07x10 ⁻⁶	8.41x10 ⁻⁶	1.66x10 ⁻⁵	1.39x10 ⁻³	1.16x10 ⁻⁶	1.24x10 ⁻⁶
	7.6%	0.026%	4.6%	0.31%	0.52%	1%	86%	0.072%	0.077%
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	8.33x10 ⁻²	0.00	0.542	0.00	0.00
	0%	0%	0%	0%	13%	0%	87%	0%	0%
MER (kg)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
EE (MJ)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

INA = Indicator not assessed | Neg. = Negligible

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.

7. References

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