Declaration Owner

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Products

Looselay Tile

Functional Unit

The functional unit is one square meter of floor covering provided and maintained for a period of 60 years.

EPD Number and Period of Validity

SCS-EPD-05498
EPD Valid May 6, 2019 through May 5, 2024

Product Category Rule

Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International. Version 2. 2014.

Program Operator

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Table of Contents

PRODUCT SCOPE.....cover
ABOUT KDF.....2
PRODUCT DESCRIPTION.....2
PRODUCT APPLICATION.....2
PRODUCT PERFORMANCE.....2
MATERIAL CONTENT.....3
PRODUCTION OF MAIN MATERIALS.....4
PRODUCT CHARACTERISTICS.....4
LIFE CYCLE ASSESSMENT.....5
FUNCTIONAL UNIT.....5
PRODUCT LIFE CYCLE FLOW DIAGRAM.....6
LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION.....7
LIFE CYCLE INVENTORY.....8
LIFE CYCLE IMPACT ASSESSMENT.....9
SUPPORTING TECHNICAL INFORMATION.....11
REFERENCES.....15

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

PCR review, was conducted by	Jack Geibig, EcoForm. jgeibig@ecoform.com
Approved Date: May 6, 2019 – End Date: May 5, 2024	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930: 2007.	☐ internal ☑ external
Third party verifier	Tom Gloria, Ph.D., Industrial Ecology Consultants

ABOUT KDF

KDF, 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 designs that steal customers' hearts, durable flooring that lasts with your life, reasonable prices to let more people enjoy better homes, and flooring that everyone would feel proud of. KDF 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.

PRODUCT DESCRIPTION

Looselay Tile in this EPD is manufactured in two ISO 9001 and ISO 14001 certified facilities in Chungnam, Republic of Korea. The manufacturer warrants for a period of 15 years from the date of purchase, which is used as the reference service life in this EPD.

PRODUCT APPLICATION

Looselay Tile is used in various commercial and residential applications.

PRODUCT PERFORMANCE

Table 1. *Product performance test results for the Looselay Tile.*

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 (m^2·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

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MATERIAL CONTENT

Table 2. *Origin and availability of material content for Looselay Tile (5.0 mm)*

Product Materials							
Component	Materials	Amount (kg/m^2)	Percent of Total (%)	Availability			Origin of Raw Materials
				Renewable	Non-renewable	Recycled (% pre-/post-consumer)	
Filler	Calcium carbonate	5.96	49%	-	Mineral, abundant	0%/0%	Global
Recycle PVC	Polyvinyl chloride	3.40	28%	-	Fossil, limited	20%/80%	Global
PVC	Polyvinyl chloride	0.722	6.0%	-	Fossil, limited	0%/0%	Global
N/S Sheet	PVC N/S sheet	0.639	5.3%	-	Fossil, limited	0%/0%	Global
Glass Fiber	Glass fiber	0.604	5.0%	-	Fossil, limited; Mineral, abundant	0%/0%	Global
Plasticizer	Dioctyl terephthalate	0.525	4.3%	-	Fossil, limited	0%/0%	Global
Film	PVC film	0.150	1.2%	-	Fossil, limited; Mineral, abundant	0%/0%	Global
Powder Stabilizer	Ba-Zn stabilizer	2.61×10^{-2}	0.22%	-	Fossil, limited; Mineral, abundant	0%/0%	Global
Pigment	Gray pigment	2.61×10^{-2}	0.22%	-	Fossil, limited; Mineral, abundant	0%/0%	Global
Liquid phase Stabilizer	Ba-Zn stabilizer	2.17×10^{-2}	0.18%	-	Fossil, limited; Mineral, abundant	0%/0%	Global
PVB Pellet	Polyvinyl butyral	2.14×10^{-2}	0.18%	-	Fossil, limited	0%/0%	Global
UV Coating	UV coating	1.50×10^{-2}	0.12%	-	Fossil, limited	0%/0%	Global
TOTAL	**-**	**12.1**	**100%**	**-**	**-**	**5.6%/22%**	**-**

In conformance with the PCR, product materials were reviewed for the presence of any hazardous chemicals. A review of Material Data Safety Sheets (MSDS) provided by the manufacturer reveals the presence of the following regulated chemicals in one or more of the products (this does not indicate that the threshold for reportable quantities is exceeded):

- Calcium carbonate (CAS# 471-34-1)
- Fiber Glass Continuous Filament (CAS# 65997-17-3)

PRODUCTION OF MAIN MATERIALS

Calcium Carbonate: An abundant mineral found worldwide and a common substance found in rocks. It can be ground into varying particle sizes.

Plasticizer: Plasticizers are used to make vinyl soft and flexible. The plasticizers used in the products declared in this EPD is dioctyl terephthalate.

Polyvinyl Chloride (PVC): Derived from fossil fuel and salt. Petroleum or natural gas is processed to make ethylene, and salt is subjected to electrolysis to separate out the natural element chlorine. Ethylene and chlorine are combined to produce ethylene dichloride, which is further processed into vinyl chloride monomer (VCM) gas. Finally, in polymerization the VCM molecule forms chains, converting the gas into fine, white powder—vinyl resin.

Stabilizers: Stabilizers are used to prevent the decomposition which occurs as PVC is heated to soften during the extrusion or molding process. Stabilizers also provide enhanced resistance to daylight, weathering and heat aging and have an important influence on the physical properties of PVC.

Glass fiber: A material consisting of numerous extremely fine fibers of glass used as a reinforcing agent for polymer products.

PRODUCT CHARACTERISTICS

Table 3. *Product characteristics for Looselay Tile (5.0 mm).*

Characteristic			Nominal Values	Unit	Maximum Value	Minimum Value
Product thickness			5.0	mm	5.0	4.0
			(0.20)	(in)	(0.20)	(0.16)
Wear layer thickness			0.5	mm	0.7	0.3
			(0.020)	(in)	(0.028)	(0.012)
Product Weight			12.10	kg/m^2	12.10	6.62
			(39.7)	(oz/ft^2)	(39.7)	(21.7)
VOC emissions test method			FloorScore®	-		
Sustainable Certifications			FloorScore®	-		
Product form	Tiles	mm	177.8	mm	600	101.6
		mm	1,219.2	mm	1,524	450

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LIFE CYCLE ASSESSMENT

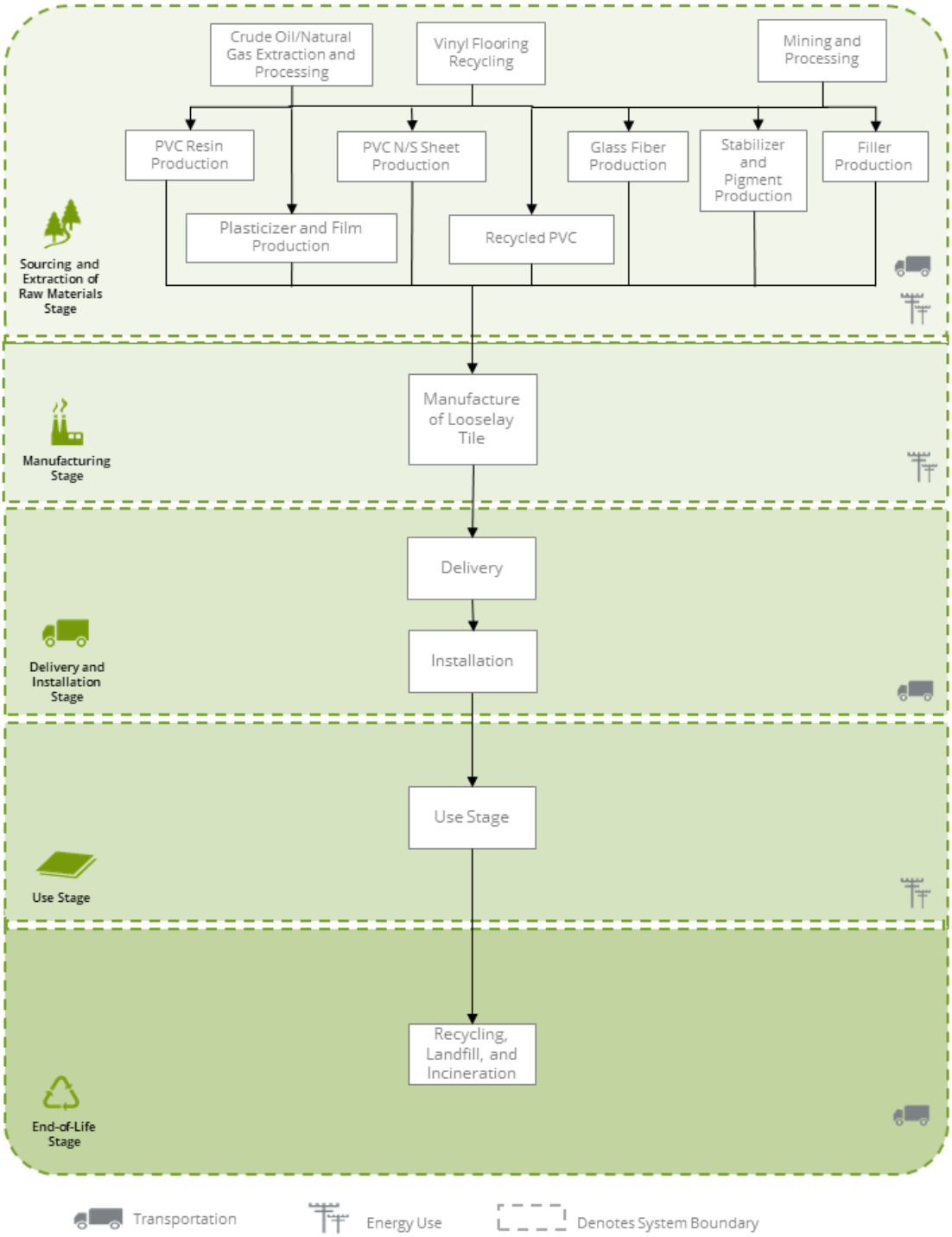
A cradle to grave life cycle assessment (LCA) was completed for this product group in accordance with ISO 14040, ISO 14044, ISO 21930, and Product Category Rule for Environmental Product Declarations for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood (Version 2).

FUNCTIONAL UNIT

The functional unit is, according to the PCR, the total impact for the expected life of the building (60 years). But the service life is dependent on the product lifetime, which is 15 years in this case. The PCR consequently requires separate reporting of LCA results A) for 1 m^2 of floor covering - extraction/processing, manufacturing, delivery and installation and end of life, B) the average 1- year use stage, and C) for the 60-year life of the building as combined using A) and B), calculated from the reference service life (RSL) of the product.

PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of Looselay Tile. This includes resource extraction and processing, product manufacture, use and maintenance, and end-of-life.



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LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION

Sourcing/Extraction Stage (raw material acquisition)

This stage includes extraction and processing of raw materials used for packaging and the manufacturing of luxury vinyl flooring, including delivery of these material components to the production site.

Manufacturing Stage

This stage includes all the relevant manufacturing processes and flows, including the impacts from energy use, emissions, and wastes at the facility. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are excluded.

Delivery and Installation Stage

Delivery

This stage includes the delivery of the flooring product to the point of installation. Modeling used in the life cycle assessment assumed an estimated distribution distance to point of sale of 9,684 kilometers (6,017 miles) via ship and 543 kilometers (994 miles) via diesel truck, representing transport from the manufacturing facility to various locations across the United States.

Installation

The manufacturer provides recommended installation guidance on the web: http://www.ikdf.co.kr/english/

Waste

Waste generated during product installation can be disposed of in a landfill, incinerated, or recycled.

Packaging

Table 4. *Origin and availability of material content for packaging of Looselay Tile (5.0 mm).*

Packaging Materials							
Component	Materials	Amount (kg/m^2)	Percent of Total (%)	Availability			Origin of Raw Materials
				Renewable	Non-renewable	Recycled (% pre-/post-consumer)	
Pallet	Hardwood	0.105	52%	Biogenic	Fossil, limited	0%/0%	Global
Air bag	Brown paper bags	4.03×10^{-2}	20%	Biogenic	Fossil, limited	0%/0%	Global
Cover board	Hardwood	2.52×10^{-2}	13%	Biogenic	-	0%/0%	Global
Corner protection strip	Corrugated board	1.61×10^{-2}	8.1%	Biogenic	Fossil, limited	0%/0%	Global
Wrapping	Low-density polyethylene	5.12×10^{-3}	2.6%	-	Fossil, limited	0%/0%	Global
Strapping	Polyester	4.36×10^{-3}	2.2%	-	Fossil, limited	0%/0%	Global
Color Box	Corrugated board	3.94×10^{-3}	2.0%	Biogenic	Fossil, limited	0%/0%	Global
Hot melt	Thermoplastic resin	1.17×10^{-4}	0.059%	-	Fossil, limited	0%/0%	Global
Instructions	Paper	6.71×10^{-5}	0.034%	Biogenic	Fossil, limited	0%/0%	Global
TOTAL	**-**	**0.200**	**100%**	**-**	**-**	**0%/0%**	**-**

Use Stage

Cleaning and maintenance

Table 5. *Cleaning and maintenance for Looselay Tile.*

Cleaning Process	Cleaning Frequency / Traffic Level			Method
	Light	Moderate	Heavy	
Daily Maintenance*	208 days/year	156 days/year	0 days/year	Sweep
Routine Cleaning	52 days/year	104 days/year	260 days/year	Sweep and mop with neutral cleaner (3 oz neutral cleaner/gal water or 23 mL neutral cleaner/ L water)

*Based on working days per year minus the days for routine cleaning.

End-of-Life Stage

Recycling, reuse, or repurpose

Data for the estimation of recycling rates for the product and packaging are based on data prepared by the US Environmental Protection Agency's Municipal Solid Waste Report. These data provide 2015 statistics on US disposal, including recycling rates.

Table 6. *Recycling rates based on 2015 US EPA Municipal Solid Waste statistics.*

Material	Packaging
Paper and paperboard	78.2%
Wood	27.1%

Disposal

The disposed product at end of life is assumed to go to landfill. Transportation of waste materials at end of life assumes a 32 kilometer (20 mile) average distance to disposal, consistent with assumptions used in the US EPA WARM model.

LIFE CYCLE INVENTORY

In accordance with ISO 21930:2007, the following aggregated inventory flows are included in the LCA, in addition to the LCIA and inventory flow requirements specified by the PCR:

- Use of renewable material resources
- Use of non-renewable material resources
- Consumption of freshwater
- Hazardous Waste
- Non-hazardous Waste

All results are calculated using the openLCA v1.7.4 model using primary and secondary inventory data. Classification for the use of material resources is based on a review of materials in the foreground system.

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Table 7. *Aggregated inventory flows, shown per 1 m^2 of Looselay Tile (5.0 mm) maintained for 60 years.*

Parameter	Units	Sourcing and Extraction	Manufacturing	Delivery and Installation	Use	End of Life	Total
Total Primary Energy Consumption							
Non-renewable energy resources	MJ	620	380	100	99	39	1,200
Renewable primary energy	MJ	45	3.3	2.1	29	0.32	79
Material Resources Consumption							
Non-renewable material resources	kg	55	0.0	Neg	16.2	Neg	71
Renewable material resources	kg	1.1	0.0	Neg	Neg	Neg	1.1
Freshwater	m^3	0.31	$2.0x10^{-2}$	$3.2x10^{-2}$	$6.5x10^{-2}$	$5.0x10^{-3}$	0.43
Waste Generated							
Hazardous waste	kg	$2.9x10^{-4}$	$5.6x10^{-2}$	$7.0x10^{-5}$	$1.4x10^{-4}$	$2.0x10^{-5}$	$5.7x10^{-2}$
Non-hazardous waste	kg	2.4	2.1	3.1	0.87	91	99

Neg = Negligible

LIFE CYCLE IMPACT ASSESSMENT

The impact assessment for the EPD is conducted in accordance with requirements of the PCR. Impact category indicators are estimated using the CML-IA (Table 8 through Table 10) and TRACI 2.1 (Table 11 through Table 13) characterization methods. Aggregated inventory flows for energy use are also calculated. The LCIA and inventory flow results are calculated using openLCA v1.7.4 software and declared in this EPD in the following ways:

- **Table A:** The potential impacts for 1 m^2 of floor covering for each of the following life cycle stages: sourcing/extraction, manufacturing, delivery and installation, and end of life. The impacts are not normalized to the 60-year reference service life of the building.
- **Table B:** The impacts for the use stage for 1 m^2 of floor covering for an average one-year use.
- **Table C:** The total impacts of all life cycle stages based on the estimated replacement schedule for 1 m^2 of floor covering over a 60-year reference service life of a building.

Table 8. *Table A: Cradle to install and end of life LCIA results for 1 m^2 of Looselay Tile (5.0 mm). Results are calculated using CML-IA.*

Impact Category	Units	Sourcing and Extraction	Manufacturing	Delivery and Installation	End of Life	Total
Abiotic Depletion Potential (Elements)	kg Sb eq	$3.5x10^{-5}$ 86%	$2.0x10^{-6}$ 4.9%	$3.3x10^{-6}$ 8.1%	$5.0x10^{-7}$ 1.2%	$4.1x10^{-5}$ 100%
Abiotic Depletion Potential (Fossil Fuels)	MJ	190 61%	81 27%	27 8.9%	10 3.4%	300 100%
Global Warming Potential	kg CO_2 eq	8.9 47%	7.0 37%	1.9 9.8%	1.2 6%	19 100%
Ozone Depletion Potential	kg CFC-11 eq	$3.9x10^{-7}$ 29%	$5.2x10^{-7}$ 40%	$2.9x10^{-7}$ 22%	$1.2x10^{-7}$ 9.3%	$1.3x10^{-6}$ 100%
Photochemical Oxidant Formation Potential	kg C_2H_4 eq	$1.8x10^{-3}$ 49%	$7.3x10^{-4}$ 21%	$8.2x10^{-4}$ 23%	$2.6x10^{-4}$ 7.2%	$3.6x10^{-3}$ 100%
Acidification Potential	kg SO_2 eq	$3.6x10^{-2}$ 44%	$2.0x10^{-2}$ 25%	$2.2x10^{-2}$ 27%	$3.1x10^{-3}$ 3.9%	$8.1x10^{-2}$ 100%
Eutrophication Potential	kg PO_4^{3-} eq	$9.4x10^{-3}$ 15%	$1.6x10^{-2}$ 25%	$3.1x10^{-3}$ 4.9%	$3.6x10^{-2}$ 56%	$6.5x10^{-2}$ 100%
Primary Energy, Non-Renewable	MJ	160 54%	96 34%	25 8.8%	10 3.4%	290 100%
Primary Energy, Renewable	MJ	11 89%	0.83 6.6%	0.52 4.1%	$7.9x10^{-2}$ 0.63%	13 100%

Table 9. *Table C: Cradle to grave impacts over 60-year building service life for 1 m^2 of Looselay Tile (5.0 mm). Results are calculated using CML-IA.*

Impact Category	Units	Sourcing and Extraction	Manufacturing	Delivery and Installation	Use	End of Life	Total
Abiotic Depletion Potential (Elements)	kg Sb eq	$1.4x10^{-4}$ 62%	$8.0x10^{-6}$ 3.5%	$1.3x10^{-5}$ 5.7%	$6.5x10^{-5}$ 28%	$2.0x10^{-6}$ 0.87%	$2.3x10^{-4}$ 100%
Abiotic Depletion Potential (Fossil Fuels)	MJ	740 56%	320 24%	110 8.1%	120 9.1%	41 3.1%	1,330 100%
Global Warming Potential	kg CO_2 eq	36 43%	28 34%	7.4 9.1%	6.1 7.5%	4.9 6.0%	82 100%
Ozone Depletion Potential	kg CFC-11 eq	$1.6x10^{-6}$ 23%	$2.1x10^{-6}$ 31%	$1.2x10^{-6}$ 17%	$1.5x10^{-6}$ 22%	$4.9x10^{-7}$ 7.3%	$6.8x10^{-6}$ 100%
Photochemical Oxidant Formation Potential	kg C_2H_4 eq	$7.1x10^{-3}$ 42%	$2.9x10^{-3}$ 17%	$3.3x10^{-3}$ 19%	$2.6x10^{-3}$ 15%	$1.0x10^{-3}$ 6.1%	$1.7x10^{-2}$ 100%
Acidification Potential	kg SO_2 eq	0.14 39%	$8.2x10^{-2}$ 22%	$8.7x10^{-2}$ 24%	$4.6x10^{-2}$ 13%	$1.3x10^{-2}$ 3.4%	0.37 100%
Eutrophication Potential	kg PO_4^{3-} eq	$3.8x10^{-2}$ 14%	$6.4x10^{-2}$ 23%	$1.3x10^{-2}$ 4.6%	$1.6x10^{-2}$ 6.0%	0.14 52%	0.28 100%
Primary Energy, Non-Renewable	MJ	620 50%	380 31%	100 8.1%	99 8.0%	39 3.1%	1,200 100%
Primary Energy, Renewable	MJ	45 57%	3.3 4.2%	2.1 2.6%	29 36%	0.32 0.40%	79 100%

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Table 10. *Table B: Average 1-year use stage impacts for 1 m^2 for Looselay Tile (5.0 mm). Results are calculated using CML-IA.*

Impact Category	Units	Average 1-year Use and Maintenance Impacts
Abiotic Depletion Potential (Elements)	kg Sb eq	$1.1x10^{-6}$
Abiotic Depletion Potential (Fossil Fuels)	MJ	2.0
Global Warming Potential	kg CO_2 eq	0.10
Ozone Depletion Potential	kg CFC-11 eq	$2.5x10^{-8}$
Photochemical Oxidant Formation Potential	kg C_2H_4 eq	$4.3x10^{-5}$
Acidification Potential	kg SO_2 eq	$7.7x10^{-4}$
Eutrophication Potential	kg PO_4^{3-} eq	$2.7x10^{-4}$
Primary Energy, Non-Renewable	MJ	1.6
Primary Energy, Renewable	MJ	0.48

Table 11. *Cradle to install and end of life LCIA results for 1 m^2 for Looselay Tile (5.0 mm). Results are calculated using TRACI 2.1.*

Impact Category	Units	Looselay Tile (5.0 mm)
Ozone depletion	kg CFC-11 eq	$1.7x10^{-6}$
Global warming	kg CO_2 eq	19
Smog	kg O_3 eq	1.5
Acidification	kg SO_2 eq	$9.0x10^{-2}$
Eutrophication	kg N eq	0.14
Fossil fuel depletion	MJ surplus	36

Table 12. *Cradle to grave impacts over 60-year building service life for 1 m^2 Looselay Tile (5.0 mm). Results are calculated using TRACI 2.1.*

Impact Category	Units	Looselay Tile (5.0 mm)
Ozone depletion	kg CFC-11 eq	$8.4x10^{-6}$
Global warming	kg CO_2 eq	85
Smog	kg O_3 eq	6.4
Acidification	kg SO_2 eq	0.41
Eutrophication	kg N eq	0.60
Fossil fuel depletion	MJ surplus	160

Table 13. *Average 1-year use stage impacts for 1 m^2 for Looselay Tile (5.0 mm). Results are calculated using TRACI 2.1.*

Impact Category	Units	Average 1-year Use and Maintenance Impacts
Ozone depletion	kg CFC-11 eq	$2.7x10^{-8}$
Global warming	kg CO_2 eq	0.14
Smog	kg O_3 eq	$8.3x10^{-3}$
Acidification	kg SO_2 eq	$8.0x10^{-4}$
Eutrophication	kg N eq	$5.3x10^{-4}$
Fossil fuel depletion	MJ surplus	0.21

SUPPORTING TECHNICAL INFORMATION

Unit processes are developed with openLCA v1.7.4 software, drawing upon data from multiple sources. Primary data were provided by KDF for their manufacturing processes. The primary sources of secondary LCI data are from Ecoinvent, Overcash, and PlasticsEurope Eco-profiles.

Table 14. *Data sources used for the LCA.*

Flow	Dataset	Data Source(s)	Database Year
Product Materials			
PVC resin	polyvinylchloride production, emulsion polymerisation | polyvinylchloride, emulsion polymerised | Cutoff, U - RoW	Ecoinvent	2018
Plasticizer	2-ethylhexyl phthalate (DEHP) {GLO} | market for | Alloc Rec U	Ecoinvent; Overcash	2018; 2004
Stabilizer	chemical production, organic | chemical, organic | Cutoff, U - GLO	Ecoinvent	2018
Pigment	carbon black production | carbon black | Cutoff, U - GLO	Ecoinvent	2018
Filler	market for limestone, crushed, for mill | limestone, crushed, for mill | Cutoff, U - RoW	Ecoinvent	2018
Film	polyvinylchloride production, emulsion polymerisation | polyvinylchloride, emulsion polymerised | Cutoff, U – RoW; market for extrusion, plastic film | extrusion, plastic film | Cutoff, U - GLO	Ecoinvent	2018
PVB Pellet	polyvinylidenchloride production, granulate | polyvinylidenchloride, granulate | Cutoff, U - RoW	MSDS; Ecoinvent	2018
UV Coating	chemical production, organic | chemical, organic | Cutoff, U - GLO	Ecoinvent	2018
PVC N/S Sheet	market for extrusion, plastic film | extrusion, plastic film | Cutoff, U – GLO; polyvinylchloride production, emulsion polymerisation | polyvinylchloride, emulsion polymerised | Cutoff, U - RoW	MSDS; Ecoinvent	2018
Glass Fiber	glass fibre production | glass fibre | Cutoff, U - RoW	Ecoinvent	2018
Installation			
Adhesive	market for acrylic binder, without water, in 34% solution state | acrylic binder, without water, in 34% solution state | Cutoff, U - RoW	Ecoinvent	2018
Maintenance			
Cleaner	market for chemical, organic | chemical, organic | Cutoff, U - GLO; market for citric acid | citric acid | Cutoff, U - GLO; market for sodium hydroxide, without water, in 50% solution state | sodium hydroxide, without water, in 50% solution state | Cutoff, U - GLO; market for water, deionised, from tap water, at user | water, deionised, from tap water, at user | Cutoff, U - RoW	MSDS; Ecoinvent	2018
Water	market for tap water | tap water | Cutoff, U - RoW	Ecoinvent	2018
Manufacturing			
Electricity	market for electricity, medium voltage | electricity, medium voltage | Cutoff, U - KR	Ecoinvent	2018
Natural Gas	heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical | heat, district or industrial, natural gas | Cutoff, U - KR	Ecoinvent	2018
Light Fuel Oil	market for diesel, burned in building machine | diesel, burned in building machine | Cutoff, U - GLO	Ecoinvent	2018
Transportation			
Truck	market for transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, U - RoW	Ecoinvent	2018
Ship	market for transport, freight, sea, transoceanic ship | transport, freight, sea, transoceanic ship | Cutoff, U - GLO	Ecoinvent	2018
Rail	market for transport, freight train | transport, freight train | Cutoff, U - RoW	Ecoinvent	2018

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Data Quality

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 10 years old. All the primary data used represented an average of one year's worth of data collection. Manufacturer supplied data are based on calendar year 2017.
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. Actual processes for upstream operations are primarily in the Republic of Korea, while downstream processes are primarily in the United States. Representative data used in the assessment are representative of Korea, US, Global, or "Rest-of-World" (average for all countries in the world with uncertainty adjusted). Datasets chosen are considered sufficiently similar to actual processes.
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 datasets, specific to the type of material or as a proxy, are used to represent the actual processes where primary data were not available.
Precision Measure of the variability of the data values for each data expressed (e.g. variance)	Precision of results are not quantified due to a lack of data. Manufacturer data, and representative data used for upstream processes 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 luxury vinyl flooring. In some instances, surrogate datasets used to represent upstream processes may be missing some data which is propagated in the model. Missing data represent less than 5% of the mass or energy flows.
Representativeness Qualitative assessment of the degree to which the data set reflects the true population of interest (i.e. geographical coverage, time period and technology coverage)	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 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 facilities represent an annual average and are considered of good 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. A mass and energy balance check were completed during the data collection period. For secondary LCI datasets, Ecoinvent, Overcash, and PlasticsEurope Eco-profiles databases are used, with a bias towards Ecoinvent data.
Uncertainty of the Information Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the luxury vinyl flooring and packaging is low. Primary data for upstream processes were not available; as such, the study relied upon use of existing representative datasets for these cases. These representative datasets contained relatively recent data (~10 years, or more recent), but in some instances lacked perfect geographical and technological representativeness. Uncertainty related to the impact assessment methods used in the study are relatively high since they lack characterization of thresholds or tipping points.

Allocation

For the raw material supply and all secondary datasets used for this LCA, processes were modelled using the cut-off system model of Ecoinvent v3.5 database.

For the transport stage, impacts were allocated based on the mass of the material and distance transported to each facility.

This LCA follows the allocation guidelines of ISO-14044 and allocation rules specified in the PCR and sought to minimize the use of allocation wherever possible.

For the manufacturing stage, mass allocation was deemed the most accurate and reproducible way of calculating resource use, emissions, and wastes for each facility (KDF and KTE). Primary data for resource use (e.g., electricity, natural gas, water, etc.), waste, and emissions released at each facility were allocated to the product on a mass-basis as a fraction of total annual production. The manufacturing stage for each product system is based on a weighted average of total production for the two facilities.

Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact must be included in the inventory. In some instances, surrogate datasets from Ecoinvent used to represent upstream processes may be missing some data which is propagated in the model.

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