

The Milliken logo is written in a blue, cursive script font.**Declaration Owner**

Milliken

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United States

+1-800-241-4826 | <https://floors.milliken.com>**Product**Mixed Formations 5mm Luxury Vinyl Tile Flooring  
(UNSPSC Class Code 30161707)**Functional Unit**

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

**EPD Number and Period of Validity**

SCS-EPD-07870

EPD Valid May 9, 2022 through May 8, 2027

**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. Sept. 2018.



PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2. UL Environment. May 2018.

**Program Operator**

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Declaration Owner:	Milliken																
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LCA Practitioner:	Gerard Mansell, Ph.D., SCS Global Services																
LCA Software and LCI database:	OpenLCA v1.10 software and the Ecoinvent v3.8 database																
Product RSL:	Various																
Markets of Applicability:	Global																
EPD Type:	Product-Specific																
EPD Scope:	Cradle-to-Grave																
LCIA Method and Version:	CML-IA and TRACI 2.1																
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LCA Reviewer:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants																
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**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. Milliken

Milliken is a leading supplier of floor coverings, with a rich history of delivering dynamic carpet and luxury vinyl tile collections from its award winning design studios and manufacturing facilities around the globe. Combining global insight with national expertise and proprietary technologies, Milliken is at the forefront of innovation and design, offering high-performance, expertly-engineered products. Founded in 1865, Milliken has achieved an amazing 150 years in the textiles business and is now one of the largest privately owned companies in the world, providing expert solutions across a range of disciplines, including specialty chemicals, floor coverings, and performance materials. With over 100 years of environmental stewardship, the Milliken family of companies is one of the world's more responsible manufacturers.

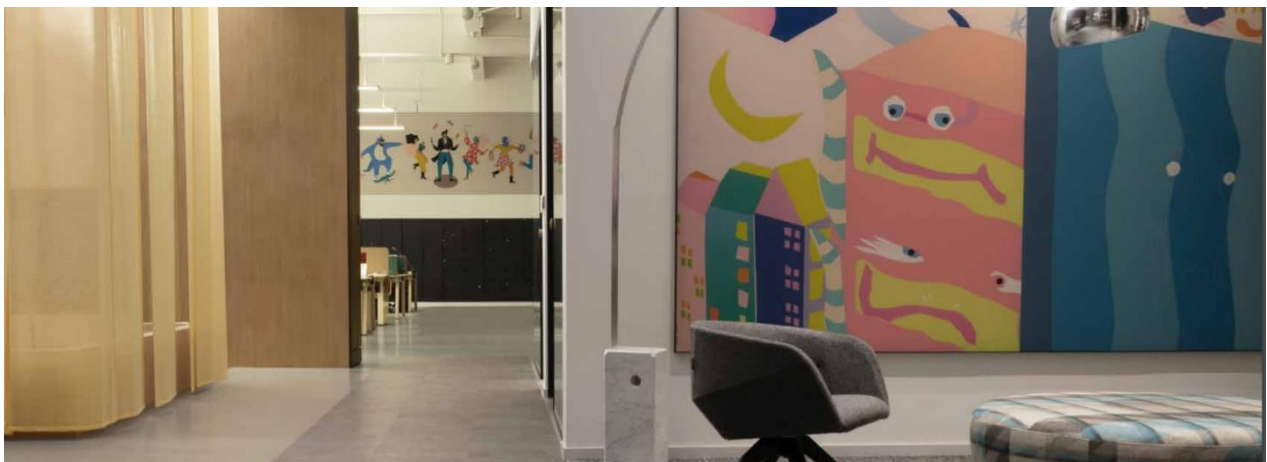
Designing innovative products and solutions for our customers is of the utmost importance. Through meaningful design, deep science and unique insights, we advance product development to the next level, while supporting Milliken's efforts to increase sustainable results and minimize environmental impact of all products. Milliken's holistic approach to innovation encompasses all stages of the life cycle - from material sourcing and manufacturing practices to end-of-life management. Our commitment to transparency, health, safety, quality and sustainability allows us to put our customers, associates, and communities first. In 2020, Milliken was named one of the World's Most Ethical Companies by the Ethisphere Institute for the fourteenth year running.

## 2. Product

### 2.1 PRODUCT DESCRIPTION

A peaceful land between home and office. The Mixed Formations Collection is a combination of natural surfaces from the outside environment. There are 4 wood patterns and 5 stone textures, in a variety of dimensional tones. We invite you to discover our approach to creating a healing environment through natural textures.

The luxury vinyl flooring is made primarily from polyvinyl chloride (PVC), calcium carbonate (mineral reinforcement), plasticizers and additives (i.e., pigments and stabilizers).



## 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 LVT flooring 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 LVT flooring product are summarized in Table 2.

**Table 2.** Product characteristics for the **Mixed Formations LVT** flooring product.

Characteristic			Description			
Sustainable certifications			FloorScore®			
VOC emissions test method			ISO 9001; ISO 14001; CE			
Characteristic			Nominal Value	Unit	Max Value	Min Value
Product thickness			5.0 (0.20)	mm (inch)	5.2 (0.20)	4.9 (0.19)
Wear layer thickness (where applicable)			0.2 (0.01)	mm (inch)	0.9 (0.04)	0.2 (0.01)
Product weight			8,230 (26.97)	g/m <sup>2</sup> (oz/ft <sup>2</sup> )	9,230 (30.2)	7,400 (24.3)
Product Form	Tiles	Width	184.2 (7.3)	mm (inch)	184.7 (7.3)	183.7 (7.2)
		Length	1219.2 (48.0)	mm (inch)	1219.7 (48.0)	1218.7 (48.0)
Product Form	Tiles	Width	228.6 (9.0)	mm (inch)	229.1 (9.0)	228.1 (9.0)
		Length	1524.0 (60.0)	mm (inch)	1524.5 (60.0)	1523.5 (60.0)
Product Form	Tiles	Width	457.2 (18.0)	mm (inch)	457.7 (18.0)	456.7 (18.0)
		Length	914.4 (36.0)	mm (inch)	914.9 (36.0)	913.9 (36.0)

## 2.6 MARKET PLACEMENT/APPLICATION RULES

Technical specifications of the flooring products are summarized below. Detailed product performance results can be found on the manufacturer's website <https://floors.milliken.com>.

## 2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

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

## 2.8 MATERIAL COMPOSITION

The luxury vinyl flooring is made primarily from polyvinyl chloride (PVC), calcium carbonate (mineral reinforcement), plasticizers and additives (i.e., pigments and stabilizers). The product is structured with multiple layers including PVC backing layers, a high definition photographic layer, a PVC wear layer and a polyurethane (PU) protective layer.

**Table 3.** Material content for the LVT flooring products in kg per square meter and percent of total mass.

Component	Mixed Formations	
	kg/m <sup>2</sup>	Percent
PVC	3.38	34%
Filler	5.26	53%
Plasticizer	1.06	11%
Stabilizer	0.067	0.68%
Pigments & Coatings	0.133	1.3%
Other	0.0085	0.086%
<b>Total Product</b>	<b>9.90</b>	<b>100%</b>

No substances required to be reported as hazardous are associated with the production of this product.

## 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 luxury vinyl tile 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. The semi-finished product is coated with a lacquer and annealed. Finally, the product is cut into tiles or 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 4.** Material content for the flooring product packaging in kg per square meter of flooring.

Component	Mixed Formations	
	kg/m <sup>2</sup>	Percent
Corrugated	0.450	52%
Plastic	1.70x10 <sup>-2</sup>	1.9%
Wood	0.405	46%
<b>Total Packaging</b>	<b>0.872</b>	<b>100%</b>

## 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 <https://floors.milliken.com>.



### 3. LCA: Calculation Rules

#### 3.1 FUNCTIONAL UNIT

The functional unit used in the study is defined as 1 m<sup>2</sup> of floor covering installed for use over a 75-year period. The corresponding reference flow for each product system is presented in Table 5. For the present assessment, a reference service lifetime (RSL) corresponding to the manufacturer's estimated 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 product in Table 9.

**Table 5.** Reference flow and RSL for the LVT flooring products.

Reference flow (kg/m <sup>2</sup> )	Reference Service Life -RSL (years)	Replacement Cycle (ESL/RSL-1)
9.90	10	6.5



### 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 6 and illustrated in Figure 1.

**Table 6.** *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	The product is installed using the manufacturer's recommended, or similar, adhesives with negligible impacts. Only impacts from packaging disposal are included in this phase.
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



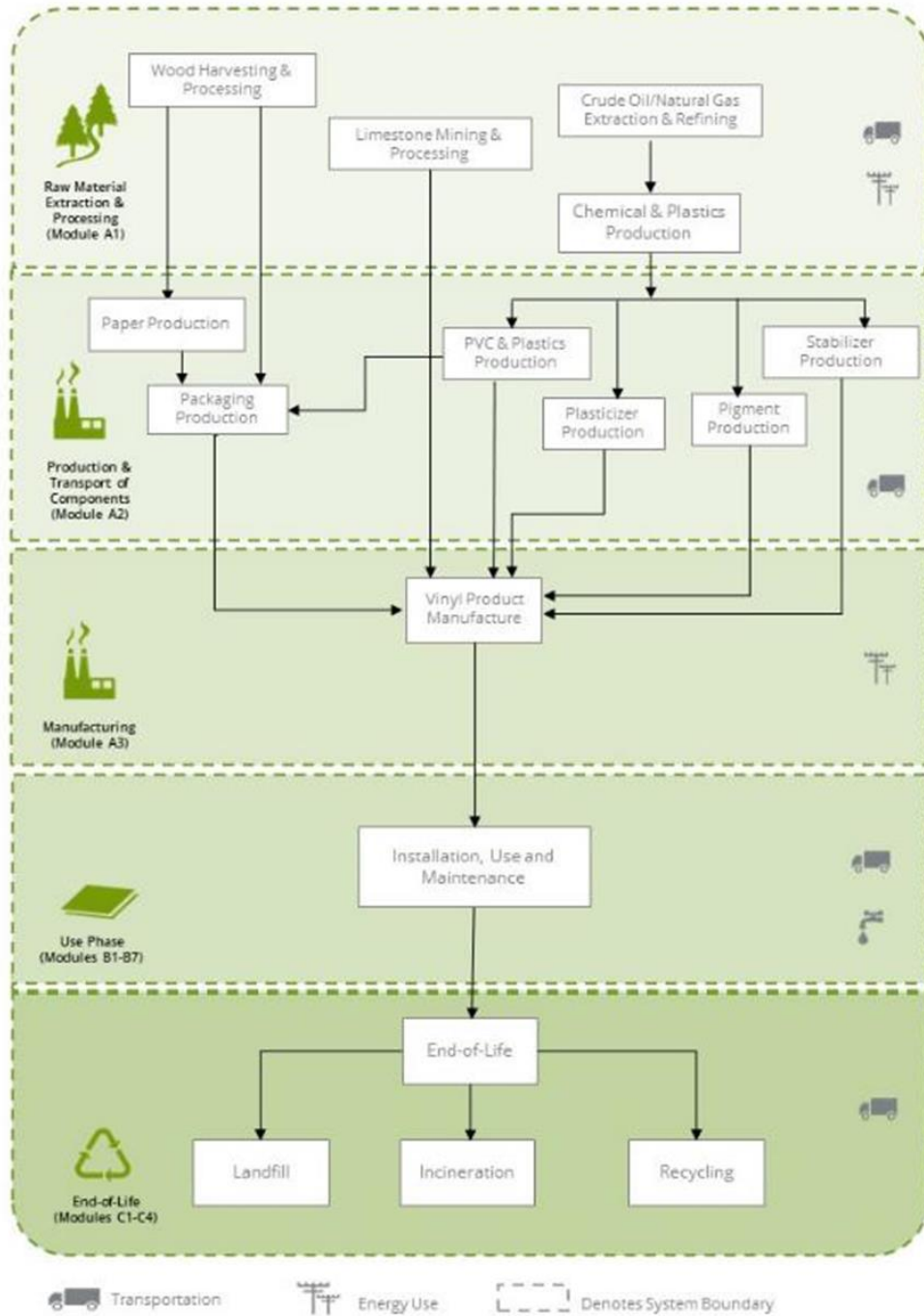


Figure 1. Flow diagram for the life cycle of the LVT flooring products.

### 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 manufacturing facility under review is located in China. Ecoinvent inventory datasets for the country-specific energy grid was used to model resource use and emissions from electricity use at the manufacturing facility.
- Life cycle inventory data for the plasticizer, dioctyl terephthalate (DOTP), were not available. Inventory data developed for diisooheptyl phthalate (DIHP) was used as a surrogate to represent DOTP in the LCA model.
- 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 product distribution to the United States, Europe, Australia and China.
- 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 20 miles 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 1% 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 and select suppliers. The sources of secondary LCI data are the Ecoinvent database.

**Table 7.** Data sources for the LVT flooring products.

Component	Dataset	Data Source	Publication data
<b>PRODUCT</b>			
PVC			
Polyvinyl Chloride	polyvinylchloride production, bulk polymerisation   polyvinylchloride, bulk polymerised   Cutoff, S/RoW	EI v3.8	2021
Filler			
Calcium Carbonate	limestone production, crushed, washed   limestone, crushed, washed   Cutoff, S/RoW	EI v3.8	2021
Plasticizer			
PVC Plasticizer	diisoheptyl phthalate (dihp) - LCI/	EI v3.8	2021
Stabilizer			
Stabilizer	barium carbonate production   barium carbonate   Cutoff, S/GLO	EI v3.8	2021
	zinc oxide production   zinc oxide   Cutoff, S/RoW	EI v3.8	2021
	solvent production, organic   solvent, organic   Cutoff, S/GLO	EI v3.8	2021
	chemical production, organic   chemical, organic   Cutoff, S/GLO	EI v3.8	2021
Pigment			
Carbon Black	market for carbon black   carbon black   Cutoff, S/GLO	EI v3.8	2021
Other			
Organic chemicals	market for chemical, organic   chemical, organic   Cutoff, S/GLO	EI v3.8	2021
Glass Fibre	glass fibre production   glass fibre   Cutoff, S/RoW	EI v3.8	2021
Urethane Acrylate	market for polyurethane, flexible foam   polyurethane, flexible foam   Cutoff, S/RoW	EI v3.8	2021
<b>PACKAGING</b>			
Cardboard	containerboard production, linerboard, kraftliner   containerboard, linerboard   Cutoff, S/RoW	EI v3.8	2021
Wrapping Film	packaging film production, low density polyethylene   packaging film, low density polyethylene   Cutoff, S/RoW	EI v3.8	2021
Polyester Strapping	polyethylene terephthalate production, granulate, amorphous   polyethylene terephthalate, granulate, amorphous   Cutoff, S/RoW	EI v3.8	2021
Wood	market for EUR-flat pallet   EUR-flat pallet   Cutoff, S/GLO	EI v3.8	2021
<b>TRANSPORT</b>			
Road transport	market for transport, freight, lorry 16-32 metric ton, EURO4   transport, freight, lorry 16-32 metric ton, EURO4   Cutoff, S/RoW	EI v3.8	2021
Ship transport	transport, freight, sea, container ship   transport, freight, sea, container ship   Cutoff, S/GLO	EI v3.8	2021
<b>RESOURCES</b>			
Grid electricity	market group for electricity, medium voltage   electricity, medium voltage   Cutoff, S/CN	EI v3.8	2021
Heat - Steam	market for heat, from steam, in chemical industry   heat, from steam, in chemical industry   Cutoff, S/RoW	EI v3.8	2021

### 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 8.** *Data quality assessment for the flooring product system.*

Data Quality Parameter	Data Quality Discussion
<b>Time-Related Coverage:</b> 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 (typically 2016). 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 2019.
<b>Geographical Coverage:</b> 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 Asia. Surrogate data used in the assessment are representative of global or European operations. Data representative of European operations are considered sufficiently similar to actual processes. Data representing product disposal are based on regional statistics.
<b>Technology Coverage:</b> 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.
<b>Precision:</b> 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.
<b>Completeness:</b> 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.
<b>Representativeness:</b> 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.
<b>Consistency:</b> 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 v3.8 data where available. Different portions of the product life cycle are equally considered.
<b>Reproducibility:</b> 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.
<b>Sources of the Data:</b> 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 v3.8 LCI data are used.
<b>Uncertainty of the Information:</b> 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 period of review calendar year 2019.

### 3.10 ALLOCATION

Manufacturing resource use was allocated to the products based on mass. Impacts from transportation were allocated 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 installation is included in the assessment. Transportation parameters for modeling transport to regional consumer markets are summarized in Table 9. A distance of 800 km is assumed for transport by diesel truck from the distribution center to point of installation, consistent with PCR guidance.

**Table 9.** Product distribution parameters by transport mode and consumer market.

Transport Mode	Consumer Market			
	United States	Europe	China	Australia
Diesel truck – Fuel utilization (L/100 km)	18.7	18.7	18.7	18.7
Diesel truck – Capacity utilization (%)	76%	76%	76%	76%
Diesel truck – Distance (km)	980	980	980	980
Ocean freighter – Fuel utilization (g/tkm)	2.5	2.5	2.5	2.5
Ocean freighter – Capacity utilization (%)	65%	65%	65%	65%
Ocean freighter – Distance (km)	10,000	9,000	-	350

Installation of the product is accomplished using hand tools with no associated emissions and negligible impacts. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements.

**Table 10.** Installation parameters for the LVT flooring products, per 1 m<sup>2</sup> (A5).

Parameter	Mixed Formations	
Ancillary materials (kg)	neg.	
Net freshwater consumption (m <sup>3</sup> )	-	
Electricity consumption (kWh)	-	
Product loss per functional unit (kg)	neg.	
Waste materials generated by product installation (kg)	neg.	
Output materials resulting from on-site waste processing (kg)	n/a	
Mass of packaging waste (kg)	Corrugated	0.450
	Plastic	1.70x10 <sup>-2</sup>
	Wood	0.405
Biogenic carbon contained in packaging (kg CO <sub>2</sub> )	1.505	
Direct emissions (kg)	-	

**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 flooring. The present assessment is based on a recommended weekly cleaning schedule including sweeping and mopping with a neutral cleaner and monthly machine cleaning.

**Table 11.** Maintenance parameters for the flooring products, per 1 m<sup>2</sup>.

Parameter	Unit	Value
Maintenance cycle	Cycles / RSL	Weekly
Maintenance cycle	Cycles / ESL	3,900
Maintenance process	-	Mopping
Net freshwater consumption	m <sup>3</sup> /m <sup>2</sup> /yr	0.0058
Cleaning agent	kg/m <sup>2</sup> /yr	0.0119
Maintenance process	-	Machine cleaning
Electricity	kWh/m <sup>2</sup> /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.

**Building operation stage (B6 – B7)**

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

**Disposal stage (C1 - C4)**

The disposal stage includes demolition of the products (C1); transport of the flooring products to waste treatment facilities (C2); waste processing (C3); and associated emissions as the product degrades in a landfill (C4). For the LVT flooring products, no emissions are generated during demolition (C1) while no waste processing (C3) is required for landfill disposal.

Transportation of waste materials at end-of-life (C2) assumes a 20 mile (~32 km) average distance to disposal, consistent with assumptions used in the US EPA WARM model. The recycling rates used for the product packaging are based on national waste disposal statistics regarding recycling rates for North America as specified in the PCR. No recycling of the product materials is assumed at end-of-life. The relevant disposal statistics used for the packaging are summarized in Table 12.



**Table 12.** *Recycling rates for materials at end-of-life by consumer market.*

Material	United States	Europe	China	Australia <sup>1</sup>
<b>Packaging</b>				
Paper & Pulp	78%	83%	-	83%
Wood	26%	40%	-	40%
Plastics	15%	40%	25%	40%
<b>Disposal of Non-recyclables</b>				
Landfill	80%	55%	75%	55%
Incineration	20%	45%	25%	45%

<sup>1</sup> Recycling rates for Australia assumed equal to Europe due to lack of regional-specific data

**Table 13.** *End-of-life disposal scenario parameters for the flooring product.*

Parameter	Value
Assumptions for scenario development	100% landfill
<b>Collection process</b>	
Collected with mixed construction waste (kg)	9.90
<b>Recovery</b>	
Landfill disposal (kg)	9.90
Removals of biogenic carbon (kg CO <sub>2</sub> 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 <sub>2</sub> eq	Global Warming Potential (GWP)	kg CO <sub>2</sub> 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 <sub>2</sub> eq	Acidification Potential (AP)	kg SO <sub>2</sub> eq
Eutrophication Potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq	Eutrophication Potential (EP)	kg N eq
Photochemical Oxidant Creation Potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq	Smog Formation Potential (SFP)	kg O <sub>3</sub> eq
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq	Fossil Fuel Depletion Potential (ADP <sub>fossil</sub> )	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 <sub>E</sub> : Renewable primary resources used as energy carrier (fuel)	MJ, LHV	HWD: Hazardous waste disposed	kg
RPR <sub>M</sub> : Renewable primary resources with energy content used as material	MJ, LHV	NHWD: Non-hazardous waste disposed	kg
NRPR <sub>E</sub> : Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	HLRW: High-level radioactive waste, conditioned, to final repository	kg
NRPR <sub>M</sub> : 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 <sup>3</sup>	-	-

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 LVT 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 14.** Life Cycle Impact Assessment (LCIA) results for the **Mixed Formations** LVT 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. (Distribution to the US)

Impact Category	A1	A2	A3	A4	A5	B2	B4	C2	C4
<b>CML-IA</b>									
GWP (kg CO <sub>2</sub> eq)	13.8	0.401	3.83	2.81	0.184	9.21	169	0.716	4.33
	6.7%	0.2%	1.9%	1.4%	0.09%	4.5%	83%	0.35%	2.1%
ODP (kg CFC-11 eq)	4.80x10 <sup>-6</sup>	6.98x10 <sup>-8</sup>	4.80x10 <sup>-8</sup>	4.72x10 <sup>-7</sup>	7.13x10 <sup>-9</sup>	4.41x10 <sup>-7</sup>	3.53x10 <sup>-5</sup>	8.12x10 <sup>-9</sup>	2.67x10 <sup>-8</sup>
	12%	0.17%	0.12%	1.1%	0.017%	1.1%	86%	0.02%	0.065%
AP (kg SO <sub>2</sub> eq)	5.32x10 <sup>-2</sup>	1.56x10 <sup>-3</sup>	1.42x10 <sup>-2</sup>	3.34x10 <sup>-2</sup>	2.12x10 <sup>-4</sup>	4.33x10 <sup>-2</sup>	0.690	2.49x10 <sup>-3</sup>	1.15x10 <sup>-3</sup>
	6.3%	0.19%	1.7%	4%	0.025%	5.2%	82%	0.3%	0.14%
EP (kg (PO <sub>4</sub> ) <sup>3-</sup> eq)	1.57x10 <sup>-2</sup>	3.61x10 <sup>-4</sup>	6.72x10 <sup>-3</sup>	4.55x10 <sup>-3</sup>	9.15x10 <sup>-4</sup>	1.61x10 <sup>-2</sup>	0.359	6.20x10 <sup>-4</sup>	2.64x10 <sup>-2</sup>
	3.7%	0.084%	1.6%	1.1%	0.21%	3.7%	83%	0.14%	6.1%
POCP (kg C <sub>2</sub> H <sub>4</sub> eq)	3.02x10 <sup>-3</sup>	5.33x10 <sup>-5</sup>	7.84x10 <sup>-4</sup>	9.16x10 <sup>-4</sup>	3.72x10 <sup>-5</sup>	2.80x10 <sup>-3</sup>	3.82x10 <sup>-2</sup>	1.43x10 <sup>-4</sup>	9.24x10 <sup>-4</sup>
	6.4%	0.11%	1.7%	2%	0.079%	6%	81%	0.31%	2%
ADPE (kg Sb eq)	1.69x10 <sup>-4</sup>	1.39x10 <sup>-6</sup>	5.83x10 <sup>-6</sup>	7.63x10 <sup>-6</sup>	5.08x10 <sup>-8</sup>	1.84x10 <sup>-4</sup>	1.23x10 <sup>-3</sup>	4.44x10 <sup>-6</sup>	5.75x10 <sup>-7</sup>
	11%	0.087%	0.36%	0.48%	0.0032%	12%	77%	0.28%	0.036%
ADPF (MJ eq)	317	5.94	30.6	39.5	0.589	197	2,730	23.1	2.89
	9.5%	0.18%	0.91%	1.2%	0.018%	5.9%	82%	0.69%	0.086%
<b>TRACI 2.1</b>									
GWP (kg CO <sub>2</sub> eq)	13.6	0.401	3.65	2.80	0.155	9.12	161	0.704	3.52
	7%	0.21%	1.9%	1.4%	0.079%	4.7%	83%	0.36%	1.8%
ODP (kg CFC-11 eq)	5.04x10 <sup>-6</sup>	9.29x10 <sup>-8</sup>	8.02x10 <sup>-8</sup>	6.29x10 <sup>-7</sup>	9.48x10 <sup>-9</sup>	5.45x10 <sup>-7</sup>	3.83x10 <sup>-5</sup>	1.07x10 <sup>-8</sup>	3.56x10 <sup>-8</sup>
	11%	0.21%	0.18%	1.4%	0.021%	1.2%	86%	0.024%	0.079%
AP (kg SO <sub>2</sub> eq)	5.40x10 <sup>-2</sup>	1.83x10 <sup>-3</sup>	1.56x10 <sup>-2</sup>	3.61x10 <sup>-2</sup>	2.63x10 <sup>-4</sup>	4.43x10 <sup>-2</sup>	0.730	2.61x10 <sup>-3</sup>	1.93x10 <sup>-3</sup>
	6.1%	0.21%	1.8%	4.1%	0.03%	5%	82%	0.29%	0.22%
EP (kg N eq)	3.03x10 <sup>-2</sup>	4.38x10 <sup>-4</sup>	1.42x10 <sup>-2</sup>	3.44x10 <sup>-3</sup>	2.43x10 <sup>-3</sup>	3.18x10 <sup>-2</sup>	0.800	1.13x10 <sup>-3</sup>	7.11x10 <sup>-2</sup>
	3.2%	0.046%	1.5%	0.36%	0.25%	3.3%	84%	0.12%	7.5%
SFP (kg O <sub>3</sub> eq)	0.676	4.39x10 <sup>-2</sup>	0.239	0.712	6.98x10 <sup>-3</sup>	0.510	11.3	3.21x10 <sup>-2</sup>	2.40x10 <sup>-2</sup>
	5%	0.32%	1.8%	5.3%	0.052%	3.8%	83%	0.24%	0.18%
FFD (MJ eq)	43.7	0.849	1.27	5.72	8.69x10 <sup>-2</sup>	26.2	360	3.31	0.373
	9.9%	0.19%	0.29%	1.3%	0.02%	5.9%	82%	0.75%	0.085%

**Table 15.** Resource use and waste flows for the **Mixed Formations** LVT 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. (Distribution to the US)

Parameter	A1	A2	A3	A4	A5	B2	B4	C2	C4
<b>Resources</b>									
RPR <sub>E</sub> (MJ)	9.74	6.93x10 <sup>-2</sup>	23.9	0.398	5.09x10 <sup>-3</sup>	20.6	224	0.264	0.115
	3.5%	0.025%	8.6%	0.14%	0.0018%	7.4%	80%	0.095%	0.041%
RPR <sub>M</sub> (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 <sub>E</sub> (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	INA
NRPR <sub>M</sub> (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	INA
SM (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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 <sup>3</sup> )	0.891	4.15x10 <sup>-3</sup>	0.167	2.33x10 <sup>-2</sup>	3.94x10 <sup>-4</sup>	1.16	7.25	2.39x10 <sup>-2</sup>	6.04x10 <sup>-3</sup>
	9.3%	0.044%	1.8%	0.24%	0.0041%	12%	76%	0.25%	0.063%
<b>Wastes</b>									
HWD (kg)	1.69x10 <sup>-4</sup>	1.59x10 <sup>-5</sup>	1.25x10 <sup>-5</sup>	8.34x10 <sup>-5</sup>	1.50x10 <sup>-6</sup>	1.12x10 <sup>-4</sup>	1.91x10 <sup>-3</sup>	2.45x10 <sup>-6</sup>	8.69x10 <sup>-6</sup>
	7.3%	0.69%	0.54%	3.6%	0.065%	4.8%	82%	0.11%	0.38%
NHWD (kg)	1.31	0.306	1.40	1.40	0.333	0.824	95.7	3.90x10 <sup>-2</sup>	9.93
	1.2%	0.27%	1.3%	1.3%	0.3%	0.74%	86%	0.035%	8.9%
HLRW (kg)	5.01x10 <sup>-5</sup>	3.05x10 <sup>-7</sup>	4.15x10 <sup>-6</sup>	1.68x10 <sup>-6</sup>	2.35x10 <sup>-8</sup>	3.63x10 <sup>-5</sup>	3.75x10 <sup>-4</sup>	8.96x10 <sup>-7</sup>	6.02x10 <sup>-7</sup>
	11%	0.065%	0.88%	0.36%	0.005%	7.7%	80%	0.19%	0.13%
ILLRW (kg)	3.85x10 <sup>-4</sup>	3.90x10 <sup>-5</sup>	2.84x10 <sup>-5</sup>	2.65x10 <sup>-4</sup>	3.98x10 <sup>-6</sup>	2.12x10 <sup>-4</sup>	4.82x10 <sup>-3</sup>	4.22x10 <sup>-6</sup>	1.58x10 <sup>-5</sup>
	6.7%	0.68%	0.49%	4.6%	0.069%	3.7%	83%	0.073%	0.27%
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	0.461	0.00	3.00	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 the exception of the Ozone Depletion Potential indicator, the product use and maintenance phase (B2) is the largest contributor to overall impacts followed by the raw material extraction and processing (A1) and product distribution (A5) phases. Other life cycle phase contributions are minimal.

## 7. Additional Environmental Information

Designing innovative products and solutions for our customers is the utmost importance. Through meaningful design, deep science and unique insights, we advance product development to the next level while supporting Milliken's efforts to increase sustainable results and minimize environmental impacts of all products.

Milliken's holistic approach to innovation encompasses all stages of the life cycle -- from material sourcing and manufacturing to end-of-life management. Our commitment to transparency, health, safety, quality and sustainability allows us to put our customers, associates and communities first.

Milliken LVT is manufactured at ISO 9001 and ISO 14001 compliant facilities.

## 8. References

1. Life Cycle Assessment of Luxury Vinyl Flooring. SCS Global Services Report. Prepared for client. March 2022.
2. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
3. ISO 14040: 2006 Environmental Management – Life cycle assessment – Principles and Framework
4. ISO 14044: 2006/AMD 1:2017/ AMD 2:2020 Environmental Management – Life cycle assessment – Requirements and Guidelines.
5. PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018
6. PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2. UL Environment. May 2018.
7. SCS Type III Environmental Declaration Program: Program Operator Manual. V11.0 November 2021. SCS Global Services.
8. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). Dr. Bare, J., <https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci>
9. CML-IA Characterization Factors. Leiden University, Institute of Environmental Sciences. April 2013. <https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors>
10. Ecoinvent Centre (2021) ecoinvent data from v3.8. Swiss Center for Life Cycle Inventories, Dübendorf, 2021, <http://www.ecoinvent.org>
11. European Joint Research Commission. International Reference Life Cycle Data System handbook. *General guide for Life Cycle Assessment – Detailed Guidance*. © European Union, 2010.
12. "WARM Model Transportation Research – Draft." Memorandum from ICF Consulting to United States Environmental Protection Agency. September 7, 2004. [https://19january2017snapshot.epa.gov/www3/epawaste/conserva/tools/warm/pdfs/retail\\_transport-memo.pdf](https://19january2017snapshot.epa.gov/www3/epawaste/conserva/tools/warm/pdfs/retail_transport-memo.pdf).





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