

ENVIRONMENTAL PRODUCT DECLARATION

HETEROGENEOUS VINYL FLOORING

RESILIENT FLOOR COVERING INSTITUTE
INDUSTRY-WIDE ENVIRONMENTAL PRODUCT DECLARATION



This environmental product declaration is provided by members of the Resilient Floor Covering Institute (RFCl) who have been environmental leaders in the building materials industry by continually developing new programs which encourage and reward flooring companies for reducing the environmental impacts of their products. These programs include: FloorScore for Indoor Air Quality, NSF/ANSI – 332 for product sustainability, and this industry-average EPD which recognizes the importance of transparency by providing information on the raw materials, production and environmental impacts of resilient flooring products.

This industry-wide EPD was facilitated by RFCl with participation from the following companies: Armstrong, Beauflor, Congoleum, Gerflor, Lonseal, Mannington, Metroflor, Mohawk, Shaw, and Tarkett.

For more information, visit:
www.rfci.com



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INDUSTRY-WIDE EPD
HETEROGENEOUS VINYL FLOORING

According to ISO 14025,
EN 15804, and ISO21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Environment 333 Pfingsten Road Northbrook, IL 60611 https://www.ul.com/ https://spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	General Program Instructions v.2.4 July 2018
MANUFACTURER NAME AND ADDRESS	Resilient Floor Covering Institute 115 Broad St, Suite 201, La Grange, GA 30240
DECLARATION NUMBER	4788753451.101.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Heterogeneous Vinyl Flooring, 1 m ²
REFERENCE PCR AND VERSION NUMBER	Part B: Flooring EPD requirements [UL Environment], v.2.0 September 2018
DESCRIPTION OF PRODUCT APPLICATION/USE	Commercial and residential flooring
PRODUCT RSL DESCRIPTION (IF APPL.)	30 years
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	January 1, 2019
PERIOD OF VALIDITY	5 Years
EPD TYPE	Industry-average
RANGE OF DATASET VARIABILITY	Industry-average only
EPD SCOPE	Cradle-to-grave
YEAR(S) OF REPORTED PRIMARY DATA	2016-2017
LCA SOFTWARE & VERSION NUMBER	GaBi ts, 8.7
LCI DATABASE(S) & VERSION NUMBER	GaBi 2018 (service pack 36)
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1

The PCR review was conducted by:

UL Environment

PCR Peer Review Panel

Chair: Jack Geibig (Ecoform)

This declaration was independently verified in accordance with ISO 14025: 2006.

INTERNAL EXTERNAL

Grant R. Martin, UL Environment

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Thomas P. Gloria, Industrial Ecology Consultants

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

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1. Product Definition and Information

1.1. Description of Company/Organization

RFCI is all about resilient flooring... and resilient flooring is all about sustainability, durability, affordability and style. It encompasses a surprisingly wide variety of hard surface flooring products – from vinyl and linoleum to rubber and cork.

The Resilient Floor Covering Institute (RFCI) is an industry trade association of leading resilient flooring manufacturers and suppliers of raw materials, additives and sundry flooring products for the North American market. The institute was established to support the interests of the total resilient floor covering industry—as well as the people and communities that use its products. For more information visit www.rfci.com.

Information in this document has been coordinated by the RFCI Technical Staff based on information submitted by the leading manufacturers of heterogeneous vinyl flooring. The product configurations offered herein use ranges representative of all types of heterogeneous vinyl flooring from ten primary manufacturers. These manufacturers own or contract facilities in the United States, Belgium, Canada, China, France, Japan, and Korea. Use of this industry average EPD is restricted to participating floor manufacturers.



Armstrong Flooring is a global leader in the design and manufacture of commercial and residential flooring. For over 100 years, Armstrong has provided high-quality, innovative and award-winning flooring designs that enable our customers to create exceptional and sustainable indoor environments.



Beauflor is a global industry leader in resilient flooring for both commercial and residential applications. As a subsidiary of the Beaulieu International Group, which was founded in Belgium and now operates in 14 countries, the company has built a reputation for producing high quality products and innovative flooring solutions. Beauflor's US headquarters is located in Cartersville, GA and has a 545,000 square feet state-of-the-art manufacturing and warehouse facility.



Inspired design and industry-leading innovation have been the hallmark of the Congoleum brand for over 125 years. Proudly manufacturing in the United States with an unwavering commitment to quality, value and customer satisfaction, Congoleum remains the flooring brand of choice in millions of homes and businesses.



For more than 70 years and in more than 100 countries, Gerflor is recognized as an expert and a world leader in its field thanks to technical, decorative and eco-responsible added-value solutions specific to each market application.



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LONSEAL
FLOORING

Lonseal is a designer and manufacturer of resilient flooring products that have pushed the limits of vinyl convention for over 35 years. Lonseal leads the vinyl surfacing industry in exciting new directions through technological, visual, and textured innovations. Our products have been featured in healthcare, educational, recreational, fitness, corporate, retail, and hospitality markets throughout the United States and across the globe.

 **MANNINGTON**

Founded in 1915, Mannington manufactures commercial and residential resilient sheet, LVT, laminate, hardwood, and premium rubber, as well as commercial carpet in eight communities across America. Known for industry-leading design, quality, customer satisfaction and environmental commitments.

 **METROFLOR**
THE LVT SPECIALISTS

Metroflor Corp. is a leading provider of luxury vinyl tile and commercial resilient sheet flooring. Our reputation as an LVT and resilient leader has been earned through our spirit of innovation: First to import beautiful, high-quality and value-driven LVT flooring, and first in research and development creating new categories, brands, and technologies which we bring to bring to life.

Mohawk Group

Mohawk Industries is the world's largest flooring manufacturer and distributor. Mohawk Group, the commercial division of Mohawk Industries offers a broad range of products in soft and hard surface flooring to meet your needs. Mohawk has solutions in resilient flooring for every segment including but not limited to Workplace/Retail, Healthcare, Education, Government, Hospitality and others. Our Enhanced Resilient collections have numerous offerings creating beautifully unique flooring designs, whether used on its own or as a perfect system with Mohawk Group carpet tiles, Woven and Broadloom carpets, and other products.

 **Shaw**
FLOORS

Shaw Industries Group, Inc. is the world's largest carpet manufacturer and a leading floor covering provider. We supply carpet, resilient, hardwood, laminate, tile & stone flooring products and synthetic turf to residential and commercial markets worldwide via our brands Anderson, Patcraft, Philadelphia Commercial, Shaw Contract Group, Shaw Floors, Shaw Hospitality Group, Shaw Sports Turf, and more.

 **Tarkett** | THE ULTIMATE FLOORING EXPERIENCE
Johnsonite Tandus Centiva 

Tarkett is a worldwide leader of innovative flooring and sports surface solutions. Offering a wide range of products including vinyl, linoleum, carpet, rubber, wood, laminate, synthetic turf and athletic tracks. Committed to "Doing Good. Together," the Group has implemented an eco-innovation strategy based on Cradle to Cradle® principles and promotes circular economy, with the ultimate goal of contributing to people's health and well-being, and preserving the natural capital.



1.2. Product Description

Product Identification

This declaration covers a broad range of styles and colors produced by RFCI manufacturers of heterogeneous vinyl flooring. A diagram of a heterogeneous vinyl flooring cross-section is shown in Figure 1. There are two basic types of heterogeneous vinyl flooring. In the Type I construction, a clear wear layer protects the décor layer below it; this layer sits on top of a separate backing layer. In Type II construction, the décor and the wear layer are one and the same and like the first construction, the product has a separate backing layer. There can be an inner construction layer(s) between the backing and the décor layer for purposes of functional property enhancement. The wear layer has a vinyl plastic binder and may include pigments, fillers, extenders and other ingredients; this layer is stabilized against heat and light deterioration. The binder of the wear layer consists of one or more resins, plasticizers and stabilizers. The wear layer may be transparent, translucent or opaque. A background or pattern under the wear layer may be printed with color inks. The surface of the wear layer may be smooth, embossed or otherwise textured.

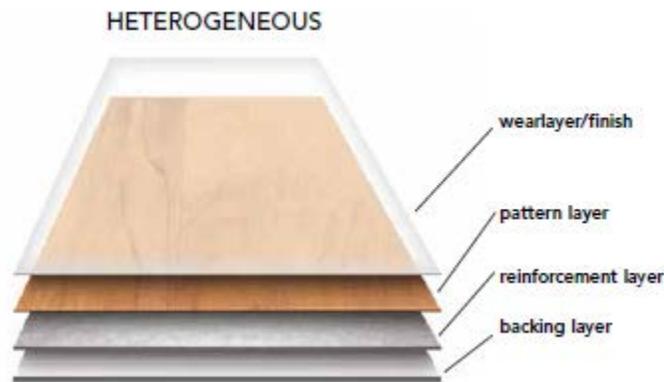


Figure 1: Diagram of heterogeneous vinyl flooring cross section

Product Specification

Heterogeneous vinyl flooring is intended for use in commercial, light commercial and residential buildings depending on the wear layer thickness. It is used in residences, multi-family dwellings, and commercially in education/institutional, hospital/healthcare, retail/mercantile, office and hospitality healthcare facilities.

Heterogeneous vinyl flooring should meet the requirements of ASTM F 1303 and ISO 10582. The flooring is available in varying thicknesses and in many different patterns. Additional information is available in Table 1 and Table 3.

Flow Diagram

The manufacturing process results in a multi-layer product with a decorative application and high-performance coating being applied to the surface of some of these products. Process flow diagrams are shown in Figure 2 and Figure 3.

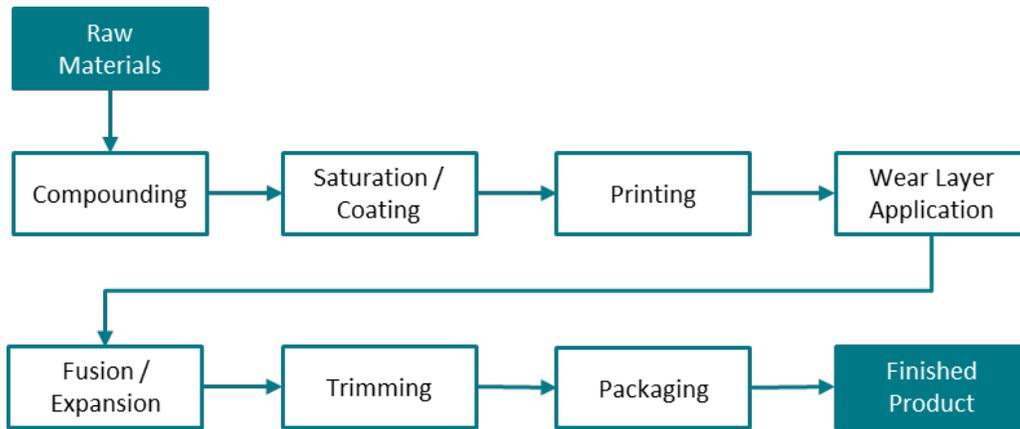


Figure 2: Diagram of production process – heterogeneous vinyl flooring

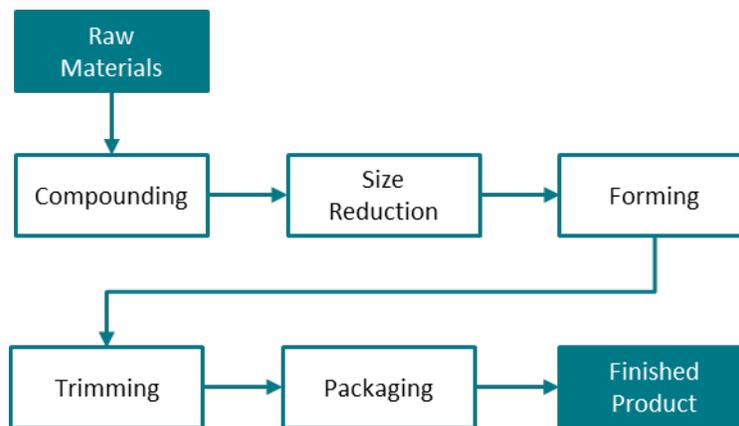


Figure 3: Diagram of production process – heterogeneous vinyl flooring with filled wear layer

Product Average

The EPD is intended to represent an industry average for heterogeneous vinyl flooring. The average is weighted based on the mass of product manufactured at each member’s facility (i.e., vertical averaging). Product accounted for in this EPD represents around 90% of heterogeneous vinyl flooring sold in North America. Key technical properties are shown in Table 1.

1.3. Application

Heterogeneous vinyl flooring is commonly used in commercial, light commercial, and residential interiors. Section 2.1 provides information about the functional unit and service life.

1.4. Declaration of Methodological Framework

The EPD analysis uses a cradle-to-grave system boundary. As such, all relevant life cycle stages and modules are included. To calculate product use and replacement over a 75-year estimated service life of the building, a 30-year reference service life is assumed for heterogeneous flooring, which results in a total of 2.5 m² of flooring needed over the building's lifetime. Additional details on cut-off and allocation procedures are found in sections 2.5 and 2.9, respectively.

1.5. Technical Requirements

Table 1: Resilient flooring technical data

HOMOGENEOUS VINYL FLOORING		AVERAGE VALUE	UNIT	MINIMUM VALUE	MAXIMUM VALUE
Product thickness			mm	1.1	5.5
Wear layer thickness			mm	0.2	0.9
Product weight*		2,100	g/m ²	1,500	3,700
Product form	Roll width		m	1.83	3.66
	Roll length		m	varies	

*To determine the average product weight, the mass of each participating manufacturer's production was used proportionately to determine the overall average value in the above chart.

1.6. Market Placement / Application Rules

The products considered in this EPD meet or exceed at least one of the following technical specifications:

- ASTM F 1303 – Standard Specification for Vinyl Sheet Floor Covering with Backing
- ISO 10582 – Resilient floor coverings – Heterogeneous polyvinyl chloride floor covering - Specification

Fire testing:

- Class 1 when tested in accordance with ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux
- Meets 450 or less when tested in accordance with ASTM E 662/NFPA 258, Standard Test Method for Smoke Density if applicable
- FSCI-150; SD-150 when tested in accordance with CAN/ULC S102.2, Standard Test Method for Flame Spread Rating and Smoke Development if applicable

1.7. Properties of Declared Product as Delivered

Refer to Table 1 for properties of products as delivered for installation.

1.8. Material Composition

Table 2: Material composition

COMPONENT	MASS %
Fillers	25%
Resin	39%
Plasticizer	20%
Pigment	1.0%
Additives	0.8%
Backing	14%
Other	< 1%

1.9. Manufacturing

RFCI members have 12 facilities that produce heterogeneous vinyl flooring in the United States, Belgium, Canada, China, France, Japan, and Korea. Floor production follows the flow diagrams shown in Figure 2 and Figure 3.

1.10. Packaging

Polypropylene wrap, polyethylene wrap, corrugated cardboard, and wood pallets are used to package heterogeneous vinyl flooring. Disposal is modeled in conformance with PCR Part A (UL, 2018) requirements (see Table 6). Landfill emissions from paper, plastic, and wood packaging are allocated to installation. Electricity generated from landfill gas (produced from the decomposition of bio-based packaging) is declared as an output from module A5 (installation).

1.11. Product Installation

This study includes transportation to the construction site by truck and flooring installation in the building. In the case of products manufactured in abroad, shipping to the US is included as part of transport to the installation site.

Installation of this product primarily involves hand tools for measuring and cutting floor materials. Flooring is unrolled and cut to size. Approximately 6% of the total material is assumed to be trimmed and discarded as waste. While some of this waste could be recycled, this scrap is modeled as being disposed of in a landfill. Hand trowels are used to spread appropriate adhesive (300 g/sqm) which adheres flooring to subfloor. Normal procedure after installation is to let rooms with installed flooring ventilate well for a minimum of 72 hours prior to occupancy.

1.12. Use

The service life of heterogeneous vinyl flooring will vary depending on the amount of floor traffic and the type and frequency of maintenance. The level of maintenance is also dependent on the actual use and desired appearance of the floor. 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 is presented based on typical installations. This EPD accounts for three cleaning processes within the use phase: dust mop, damp mop, and spray buffing, as detailed in Table 4 and Table 5 and summarized in Table 10.

1.13. Reference Service Life and Estimated Building Service Life

The reference service life (RSL) for heterogeneous vinyl flooring is 30 years, meaning that the product will meet its functional requirements for an average of 30 years before replacement. Estimated building service life is 75 years, as specified by the PCR. Additional information is provided in Table 9.

1.14. Reuse, Recycling, and Energy Recovery

Heterogeneous vinyl flooring is typically not reused or recycled following its removal from a building. Thus, reuse, recycling, and energy recovery are not applicable for this product.

1.15. Disposal

At the end-of-life, the product is assumed to be disposed per PCR requirements (UL, 2018) (see Table 6). Waste classification is based on the Resource Conservation and Recovery Act (RCRA) (EPA, n.d.).

1.16. Further Information

No further information on heterogeneous vinyl flooring is provided.

2. Life Cycle Assessment Background Information

A full life cycle assessment has been carried out according to ISO 14040 (ISO, 2009) and 14044 (ISO, 2006), per the product category rules (PCR) for Flooring as published by UL Environment (UL, 2018).

2.1. Functional or Declared Unit

The declaration refers to the functional unit of 1m² installed floor covering. Heterogeneous vinyl flooring is assumed to have a reference service life of 30 years and installation losses of 6%. Therefore, over the 75-year building estimated service life, 1.5 replacements take place and an additional 0.15 m² of product is needed to compensate for installation losses.

Table 3: Functional unit information

NAME	VALUE
Functional unit	1 m ²
Mass	2.1 kg / m ²
Reference flow	2.7 m ² @ 5.6 kg

2.2. System Boundary

The system boundary of the EPD is “cradle-to-grave”. As such, the analysis includes the following modules:

- Product stage: modules A1 to A3
- Construction stage: modules A4 and A5
- Use stage: modules B1 to B5, B6, and B7

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- End-of-life stage: modules C1 to C4
- Benefits and loads beyond the system boundary: module D

Each module includes provision of all relevant materials, products and energy. Potential impacts and aspects related to wastage (i.e. production, transport and waste processing and end-of-life stage of lost waste products and materials) are considered in the module in which the wastage occurs.

The use stage modules B1, B3, B5, B6, and B7 are declared as having zero impact as there are no direct emissions from resilient flooring once it is installed nor is any repair or refurbishment requirements expected. The other use stage modules account for cleaning the floor (i.e., maintenance, which consists of dust mopping, damp mopping, and spray buffing), and replacing the floor to match building service life.

Module D is considered in the analysis. It represents the benefits/loads beyond the system boundary—in particular, credits from capturing methane gas from landfilling of biodegradable materials which is used for electricity generation.

Per the PCR, capital goods and infrastructure flows are assumed to not significantly affect LCA results or conclusions and thus excluded from the analysis.

2.3. Product-specific Calculations for Use Phase

Table 4 and Table 5 detail cleaning process assumptions and cleaning process inputs as calculated based on the assumptions.

Table 4: Cleaning process assumptions

LEVEL OF USE	CLEANING PROCESS	CLEANING FREQUENCY	CONSUMPTION OF ENERGY AND RESOURCES
Commercial / residential / industrial	Dust mop	Daily	None
	Damp mop / neutral cleaner	Weekly	Hot water, neutral detergent
	Spray buff / finish restorer	Monthly	Floor finish, electricity

Table 5: Cleaning inputs

COMPONENT	AMOUNT	UNITS
Detergent	119	mL / m ² / yr.
Electricity	0.022	kWh / m ² / yr.
Finish	0.12	L / m ² / yr.
Finish remover	0	L / m ² / yr.
Water	5.8	L / m ² / yr.

2.4. Estimates and Assumptions

Per the PCR (UL, 2018), a distance of 800 km (497 miles) by diesel-powered truck is used to represent the distribution of product to the installation site within the US. For products manufactured outside of the US, inbound transportation by cargo ship is also included.



Product transport from building site to waste processing is assumed to be 161 km (100 miles) by diesel-powered truck. The same assumption is used for transporting deconstructed product at end-of-life. Lastly, product and packaging disposal assumptions are consistent with PCR requirements (Table 6).

Table 6: End-of-life assumptions

COMPONENT	RECYCLED	LANDFILLED	INCINERATED
Product	0%	100%	0%
Paper packaging	75%	20%	5%
Plastic packaging	15%	68%	17%

2.5. Cut-off Criteria

Cut-off criteria were applied to a small number of raw materials representing less than 1% of input material mass in order to facilitate handling the wide variety of additives and other raw material inputs to resilient flooring.

2.6. Data Sources

As a general rule, specific data derived from specific production processes or average data derived from specific production processes were the first choice as a basis for calculating LCA results.

For life cycle modeling of the considered products, the GaBi Software System for Life Cycle Engineering, developed and maintained by thinkstep AG, was used to model the product systems considered in this assessment. All relevant background datasets were taken from the GaBi 2018 software database (service pack 36). The datasets from the GaBi database are documented in the online documentation (thinkstep, 2018). To maximize comparability of results within the LCA, GaBi background data were used for energy, transportation and auxiliary materials.

2.7. Data Quality

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

Temporal Coverage

Foreground data represent a continuous 12-month period over the 2016 and 2017 calendar years. Manufacturers were permitted to choose to report for a calendar year or a fiscal year to facilitate data collection. Background datasets are all based on data from the last 7 years (since 2011), with the majority of datasets based on data from 2014 or later.

Geographical Coverage

To satisfy cut-off criteria, proxy datasets were used as needed for raw material inputs to address lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their representativeness of the actual product. Additionally, European data or global data were used when North American data (for raw materials sourced in the US) were not available.

Technological Coverage

The primary data represent production of the products under evaluation. Secondary data were chosen to be specific to the technologies in question (or appropriate proxy data used where necessary).

2.8. Period under Review

Primary data were collected for production during the 2016 and 2017 calendar years. This analysis is intended to represent production in 2017.

2.9. Allocation

Given that raw materials are key contributors to environmental performance, mass-based allocation was applied for facilities that produced more than one flooring product. No allocation is required for products at end-of-life: plastic is assumed to be inert in landfills, so no landfill gas is produced from product waste. Bio-based packaging waste, however, may decompose and produce landfill gas, which is assumed to be collected and used to generate electricity. Under the polluter-pays principle, the product system carries the burden of landfilling.

2.10. Comparability

No comparisons or benchmarking is included in this EPD. LCA results across EPDs can be calculated with different background databases, modeling assumptions, geographic scope and time periods, all of which are valid and acceptable according to the Product Category Rules (PCR) and ISO standards. Caution should be used when attempting to compare EPD results.

3. Life Cycle Assessment Scenarios

Scenario assumptions are provided in Table 7 through Table 16. Items that are excluded from these tables (c.f., PCR Part B: Flooring EPD requirements (UL, 2018)) are assumed to be zero. (For example, electricity consumption is not listed in Table 8 because electricity is not need to install resilient flooring.) Furthermore, modules B1, B3, B5, B6, and B7 are not associated with any activity. The tables for these modules are thus limited to a couple rows each to indicate that the modules are included within the system boundary but that there are no inputs or outputs associated with them.

Table 7. Transport to the building site (A4)

NAME	VALUE	UNIT
Fuel type	Diesel	
Liters of fuel	35	l/100km
Vehicle type	Truck (trailer)	
Transport distance	800	km
Capacity utilization (including empty runs, mass based)	78	%
Gross density of products transported	2.1	kg/m ²
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	1	-

Table 8. Installation into the building (A5)

NAME	VALUE	UNIT
Ancillary materials	0.3	kg
Product loss per functional unit	0.13	kg
Waste materials at the construction site before waste processing, generated by product installation (incl. product loss)	0.16	kg
Biogenic carbon contained in packaging	0.048	kg CO ₂

Table 9. Reference service life

NAME	VALUE	UNIT
RSL	30	years

Table 10. Maintenance (B2)

NAME	VALUE	UNIT
Maintenance process information (cite source in report)	See section 2.3	-
Maintenance cycle (reference service life)	1,560 (weekly)	Number/ RSL
Maintenance cycle (estimated service life)	3,900 (weekly)	Number/ ESL
Net freshwater consumption: municipal water to POTW	0.435	m ³ / ESL
Ancillary materials specified		
Detergent	8.9	kg / ESL
Finish	9.0	
Finish remover	0	
Electricity input for spray buffing	1.7	kWh / ESL
Power output of equipment	1.1	kW

Table 11. Repair (B3)

NAME	VALUE	UNIT
Repair cycle (reference service life)	0	Number/ RSL
Repair cycle (estimated service life)	0	Number/ ESL

Table 12. Replacement (B4)

NAME	VALUE	UNIT
Replacement cycle (reference service lifetime)	0	Number/ RSL
Replacement cycle (estimated service lifetime)	1.5	Number/ ESL
Ancillary materials specified by type (e.g. cleaning agent)	0.45	kg / ESL
Replacement of worn parts, specify parts/materials	3.2	kg / ESL
Further assumptions for scenario development, e.g. frequency and time period of use	N/A	As appropriate

Table 13. Refurbishment (B5)

NAME	VALUE	UNIT
Refurbishment cycle (reference service life)	0	Number/ RSL
Refurbishment cycle (estimated service life)	0	Number/ ESL

Table 14. Operational energy use (B6) and operational water use (B7)

NAME	VALUE	UNIT
Net freshwater consumption specified by water source and fate	0	m ³
Energy input, specified by activity, type and amount	0	kWh

Table 15. End of life (C1-C4)

NAME		VALUE	UNIT
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)			
Collection process (specified by type)	Collected separately	2.1	kg
	Collected with mixed construction waste	0	kg
Recovery (specified by type)	Reuse	0	kg
	Recycling	0	kg
	Landfill	2.1	kg
	Incineration	0	kg
	Incineration with energy recovery	0	kg
	Energy conversion efficiency rate	0	
Disposal (specified by type)	Product or material for final deposition	2.1	kg
Removals of biogenic carbon (excluding packaging)		0	kg CO ₂

Table 16. Reuse, recovery and/or recycling potentials (D), relevant scenario information

NAME	VALUE	UNIT
Net energy benefit from energy recovery from waste treatment of packaging from A5	0.011	MJ
Net energy benefit from energy recovery from waste treatment of packaging from B4	0.016	MJ

4. Life Cycle Assessment Results

It is important to note that the reported results represent an average of the RFCI members participating in this EPD based on the square meters produced by each manufacturer for sale in North America. Caution should be used when trying to compare the results presented in this EPD to the environmental performance of other heterogeneous vinyl flooring products as the thickness of floors will influence the environmental impacts. Although the environmental

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impacts should be lower for the thinner floors (less raw materials), a thicker floor most often lasts longer, counteracting the advantage gained by a thinner floor.

Table 17. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				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 supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential	
EPD Type: Cradle-to-grave	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 18 through Table 20 contain cradle-to-grave results for 1m² of flooring over the 75-year building estimated service life. Modules B1, B3, B5, B6, and B7 are not associated with any impact and are therefore declared as zero. Furthermore, module C1 is likewise not associated with any impact as the floor is manually deconstructed. In interest of space and table readability, these modules are not included in the results below. To calculate cradle-to-grave impact over a shorter timeframe, sum all modules, divide that number by 75 years, and multiply by the life expectancy of the flooring in a specific project.

4.1. Life Cycle Impact Assessment Results

Table 18. North American impact assessment results for 1m² of flooring over 75 years

TRACI v2.1	A1-A3	A4	A5	B2	B4	C2	C4	D
GWP 100 [kg CO ₂ eq]	7.04E+00	7.07E-02	7.69E-01	6.10E+00	1.20E+01	2.37E-02	9.40E-02	-3.77E-03
ODP [kg CFC-11 eq]	1.63E-10	2.04E-15	1.02E-11	2.93E-12	2.59E-10	7.02E-16	1.70E-14	-4.59E-15
AP [kg SO ₂ eq]	1.94E-02	7.95E-04	1.86E-03	1.83E-02	3.39E-02	5.46E-05	4.27E-04	-1.02E-05
EP [kg N eq]	5.96E-03	3.42E-05	4.58E-04	1.71E-02	9.72E-03	5.60E-06	2.16E-05	-4.29E-07
SFP [kg O ₃ eq]	3.28E-01	1.61E-02	3.24E-02	2.10E-01	5.80E-01	1.69E-03	8.47E-03	-8.94E-05
ADP _{fossil} [MJ, surplus]	1.88E+01	1.36E-01	2.37E+00	1.55E+01	3.23E+01	4.81E-02	1.85E-01	-3.97E-03



4.2. Life Cycle Inventory Results

Table 19. Resource use for 1m² of flooring over 75 years

PARAMETER	A1-A3	A4	A5	B2	B4	C2	C4	D
RPR _E [MJ, LHV]	9.70E+00	1.90E-02	1.90E+00	4.95E+00	1.60E+01	8.70E-03	1.04E-01	-6.34E-03
RPR _M [MJ, LHV]	9.91E-01	0	5.95E-02	0	1.58E+00	0	0	0
NRPR _E [MJ, LHV]	1.16E+02	1.02E+00	1.59E+01	1.26E+02	1.41E+02	3.60E-01	1.48E+00	-5.90E-02
NRPR _M [MJ, LHV]	3.84E+01	0	2.30E+00	0	6.10E+01	0	0	0
SM [kg]	0	0	0	0	0	0	0	0
RSF [MJ, LHV]	0	0	0	0	0	0	0	0
NRSF [MJ, LHV]	0	0	0	0	0	0	0	0
RE [MJ, LHV]	0	0	0	0	0	0	0	0
FW [m ³]	3.66E-02	9.25E-05	3.48E-03	4.16E-02	6.07E-02	4.28E-05	1.79E-04	-1.80E-05

Table 20. Output flows and waste categories for 1m² of flooring over 75 years

PARAMETER	A1-A3	A4	A5	B2	B4	C2	C4	D
HWD [kg]	9.67E-07	5.82E-09	7.28E-08	-8.07E-07	1.58E-06	2.81E-09	5.09E-09	-2.64E-11
NHWD [kg]	2.69E-01	3.07E-05	1.53E-01	1.38E+00	3.79E+00	1.30E-05	2.11E+00	-1.80E-05
HLRW [kg]	5.02E-06	2.23E-09	4.01E-07	3.26E-06	8.16E-06	7.67E-10	1.92E-08	-5.11E-09
ILLRW [kg]	4.01E-03	1.85E-06	3.11E-04	2.66E-03	6.51E-03	6.35E-07	1.52E-05	-4.26E-06
CRU [kg]	0	0	0	0	0	0	0	0
MR [kg]	0	0	2.31E-02	0	3.47E-02	0	0	0
MER [kg]	0	0	0	0	0	0	0	0
EE, electrical [MJ, LHV]	0	0	8.12E-03	0	1.22E-02	0	0	0
EE, thermal [MJ, LHV]	0	0	2.88E-03	0	4.31E-03	0	0	0

Biogenic carbon is not reported in GWP as resilient flooring products do not typically contain bio-based materials. As such, carbon emissions and removals are not declared.

5. LCA Interpretation

Under the 75-year building service life assumption, product manufacturing (A1-A3) and recommended maintenance (B2) are the two largest contributors to most impact categories considered. The production of raw materials represents a substantial fraction of potential impact, even over the life of a building. The potential impacts of flooring maintenance add up over time and are relevant contributors to the life cycle. Transportation of the flooring product from the manufacturing facility to the installation site (A4) is a relatively minor contributor to all impact categories. Replacement (B4), on the other hand, is a key contributor because it represents the production, installation, and disposal of replacement products needed to satisfy the 75-year building service life.

6. Additional Environmental Information

6.1. Mandatory Environmental Information

With one exception, no substances required to be reported as hazardous (as determined under the Resource Conservation and Recovery Act (RCRA) (EPA, n.d.)) are associated with the production of heterogeneous vinyl flooring. One of the participants in this EPD is in the process of phasing out DEHP and substituting a terephthalate plasticizer.

6.2. Extraordinary Effects

Prevention of Structural Damage

Heavy furniture and equipment should be kept off the floor for a minimum of 72 hours after floor installation to allow the adhesive to set. Damage from wheeled vehicles, castered furniture and dollies can be prevented by using proper furniture rests, wheels or casters with suitable widths and diameters for the loads to be carried.

Moisture in subfloors is an important consideration for the successful installation of heterogeneous vinyl flooring. To avoid damage from moisture, recommended guidelines in ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring and ASTM F 1482 Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring should be followed.

6.3. Environmental Activities and Certifications

The flooring products in this EPD comply with the VOC emissions requirements in the California Department of Public Health (CDPH) Standard Method v1.1 as certified by the FloorScore Certification Program for Indoor Air Quality. Low VOC cleaning materials are available for use in maintaining heterogeneous vinyl flooring.

7. References

- EPA. (n.d.). Resource Conservation and Recovery Act (RCRA) Laws and Regulations. Retrieved Oct 16, 2018, from Environmental Protection Agency: <https://www.epa.gov/rcra>
- European Standards. (2013). EN 15804+A1 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
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- thinkstep. (2018). GaBi ts: Software system and database for life cycle engineering. Stuttgart, Echterdingen, Germany.
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ENVIRONMENTAL PRODUCT DECLARATION



INDUSTRY-WIDE EPD
HETEROGENEOUS VINYL FLOORING



According to ISO 14025,
EN 15804 and ISO 21930:2017

Assessment Calculation Rules and Report Requirements.

8. Contact Information

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