Environmental Product Declaration

Rubber Floor Tile

INDUSTRY-WIDE ENVIRONMENTAL PRODUCT DECLARATION

This Environmental Product Declaration is provided by members of the Resilient Floor Covering Institute (RFCI) 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 is an industry-wide EPD facilitated by RFCI with participation from the following companies:

- American Biltrite
- Armstrong
- Burke
- FLEXCO
- Johnsonite
- Mannington
- Roppe
- Tarkett

For more information visit: www.rfci.com.

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

Industry-Wide EPD
Rubber Floor Tile

According to ISO 14025

This Environmental Product Declaration (EPD) has been prepared in accordance with ISO 14025 for Type III environmental performance labels. This EPD does not guarantee that any performance benchmarks, including environmental performance benchmarks, are met. EPDs provide life cycle assessment (LCA)-based information and additional information on the environmental aspects of products to assist purchasers and users to make informed comparisons between products. In providing transparent information about environmental impacts of products over their life cycle, EPDs encourage improvement of environmental performance . EPDs not based on an LCA covering all life cycle stages, or based on a different Product Category Rules (PCR), are examples of declarations that have limited comparability. EPDs from different programs may also not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Resilient Floor Covering Institute
DECLARATION NUMBER	12CA56057.103.1
DECLARED PRODUCT	Rubber Floor Tile
REFERENCE PCR	Flooring: Carpet, Resilient, Laminate, Ceramic, and Wood (NSF 2012)

DATE OF ISSUE	11 July 2013
PERIOD OF VALIDITY	5 years

CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	NSF International Accepted by PCR Review Panel ncss@nsf.org
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Hilary Young
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas Gloria, Life-Cycle Services, LLC

Industry-Wide EPD
Rubber Floor Tile

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Resilient Floor Covering Institute

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 rubber floor tile. The product configurations offered herein use ranges representative of all types of rubber floor tile from the following four primary manufacturers:

AmericanBiltrite

Founded in 1908, American Biltrite offers a select range of flooring solutions for the educational, healthcare and institutional sectors. With high aesthetics, great durability, low maintenance and excellent environmental qualities, our collections offer the best alternatives for every project. Products include resilient rubber sheet and tile, PVC/VOC-free tile, solid vinyl tile, and low-VOC luxury vinyl tiles.

Armstrong®

Armstrong World Industries 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.

Burke FLOORING

Burke, a Mannington company, is a single source supplier for rubber flooring and accessories that are as durable, resilient, and as eco-friendly as they are beautiful. Truly premium formulations meet the styling, performance and maintenance demands of commercial applications.

FLEXCO®
innovative design. flooring performance.

FLEXCO has been in business for more than 65 years and has advanced as an industry pioneer and innovator by remaining, performance-driven, progress-oriented and partnership-minded. We take the initiative to bring you the very best flooring options available today, in doing this we strive to stay informed of all the latest technical information, testing, sustainable and safety standards, industry news, trends in color and design and much more. FLEXCO takes pride in being a resilient flooring partner that has the experience, the determination and the dedication to make your flooring visions become realities.

Johnsonite®
A Tarkett Company

Johnsonite is celebrating over 100 years as a leading provider of innovative flooring solutions that integrate function, design, life safety, and sustainability to enhance productivity in commercial spaces. Johnsonite is the North American commercial resilient brand of the Tarkett Group. Johnsonite's mission is geared toward enhancing the productivity and well-being of the people who design, manufacture, distribute, live and work with their products daily.

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

Roppe is celebrating over 50 years as a leading manufacturer in the commercial flooring industry. Our company is family owned, and is a very integral part of the small Midwestern town of Fostoria, Ohio, where our headquarters are located.

With more than 130 years of history, Tarkett is a worldwide leader of innovative and sustainable flooring and sports surface solutions. Tarkett provides integrated and coordinated flooring and sports surface solutions to professionals and end-users that measurably enhance both people's quality of life and building facilities' life-time return.

Use of EPDs

Two main purposes for creating EPDs are promoting transparency of environmental performance and verbalizing complex life cycle assessment information in a standardized way. Additionally there is a desire to try and compare life cycle information across similar product categories. The current EPD landscape emphasizes transparency and standardization of format, but exact comparability is not always possible. 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.

This EPD follows the specifications of PCR Flooring: Carpet, Resilient, Laminate, Ceramic, and Wood (NSF 2012). Eco-toxicity and human health assessments are not part of this PCR and are not addressed in this EPD. The current available models used to calculate eco-toxicity and human health assessments impact categories have a large amount of uncertainty and variation in their results. Over time, it is expected that research will improve the accuracy of these models making the results meaningful like other impact categories (i.e. greenhouse gas, acidification, etc.).

Product Definition

Product Classification and Description

This declaration for traditional Rubber Floor Tile covers a broad range of classes, styles, and colors produced by six major manufacturers. Rubber tile is classified as homogeneous (solid color or through mottled) or heterogeneous (layered) (solid color wear layer and mottled wear layer). The rubber tile represented in this EPD includes both classifications. Rubber tile is vulcanized and is made from a homogeneous composition of synthetic and/or natural rubber, high quality additives, and colorants. This tile is most often used in commercial buildings. The rubber tile is produced in thicknesses of 2.0mm, 3.0mm, 3.2mm, 5.2mm, and 6.4mm. Rubber tiles manufactured using crumb rubber derived from recycled rubber tires are outside the scope of this document.

The manufacturing process results in either single layer or multi- layer products.

Figure 1: Diagram of Rubber Floor Tile Cross-Section

Range of Applications

Rubber tile is typically used commercially in healthcare, educational, retail, transportation, institutional, and office interiors.

Product Standards

The products considered in this EPD meet or exceed the following Technical Specifications:

- ASTM F 1344 – Standard Specification for Rubber Floor Tile

Fire Testing:

- Class 1 when tested in accordance with ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux 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

Accreditations

Compliant with FloorScore Flooring Products Certification Program for Indoor Air Quality.

Product Characteristics

Rubber Floor Tile		Average Value	Unit	Minimum Value	Maximum Value
Product Thickness			mm	2	7.5
Wear layer thickness			mm	None	2
Product weight *		5,234	g/m^2	4,724	5,429
Product Form:	**Tiles**		mm	457 x 457	914 x 914
VOC emissions test method	*Compliant with California Department of public Health Standard v1.1, 2010 and certified by FloorScore Flooring Products Certification Program for Indoor Air Quality*				
Sustainability certifications	Some products certified to NSF / ANSI – 332 Sustainability Assessment for Resilient Floor Coverings				

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

Material Content

Material Content of the Product

Component	Material	Mass %	Availability			Origin of raw materials
			Renewable	Non-renewable	Recycled	
Fillers	Kaolin	64.9%		Mineral abundant		Global
Binder	SBR	27.4%		Fossil limited		US
Additives	Various	5.1%		Mineral abundant		US / China
Binder	Polybutadiene	1.2%		Fossil limited		US
Binder	Natural rubber	0.6%	Bio-crop based	Fossil limited		US
Other components	Various	0.8%		Fossil limited		Global

Production of Main Materials

Kaolin:

A clay mineral used as inert filler.

Styrene Butadiene Rubber (SBR) and Polybutadiene:

Rubber produced by polymerizing one or more monomers with or without post-polymerization chemical modification. SBR and Poybutadiene are both examples of synthetic rubber. SBR, the most common is made by the copolymerization of styrene and butadiene. Polybutadiene is formed from the polymerization process of 1,3-butadiene monomer.

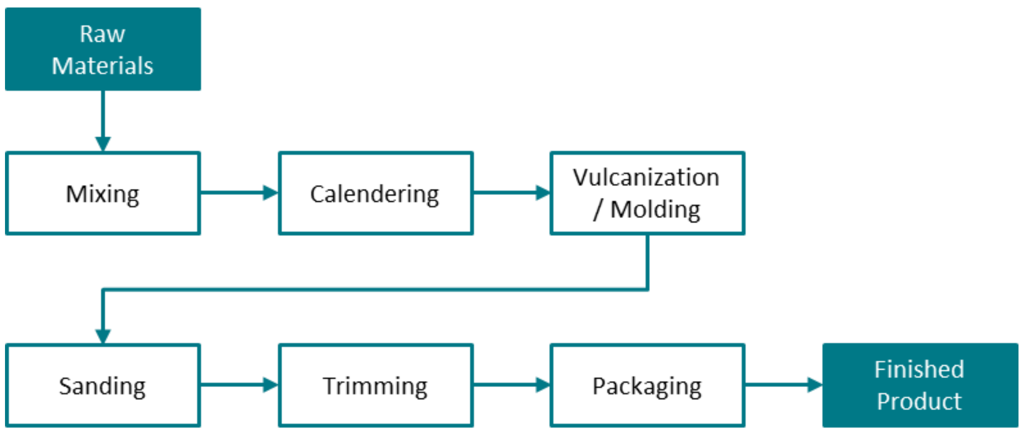
Natural Rubber:

n-cis 1,4-polyisoprene that is obtained from plant sources, including *Hevea brasiliensis(*rubber tree) and *parthenium argentatum(*guayule).

Production of the Floor Covering

Rubber floor tile is produced in several stages beginning with the mixing of the raw materials. After thorough mixing of the raw materials, the resulting compound is calendared into sheets, typically referred to as "preforms". The preforms are then placed in heated molds where they are pressed into tiles. After the molding operation, the tiles are finished where their backs are sanded to obtain the correct thickness, as well as to enhance adhesion, and then cut to their finished size for packaging.

Figure 2: Diagram of Production Process



Production Waste

On average, 9.7% of production materials are sent to the the landfill as waste.

Delivery and Installation of the Floor Covering

Delivery

In this study, transport to construction site by truck and flooring installation in the building are included.

Installation

Adhesive is typically required for installation; 300 grams / square meter are used. During installation, approximately 4.5% of the total material is cut off as waste. Though some of this waste could be recycled, this scrap is modeled in this EPD as being disposed of in a landfill.

Waste

Both installed product waste and packaging waste are assumed to be sent to a landfill for this EPD (although packaging material is often recycled in local programs). 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 assumed to replace energy on the US grid.

Packaging

This EPD presumes that polyethylene wrap, cardboard, and wood packaging are sent with the flooring material to the jobsite and then sent to landfill as waste.

Use Stage

The service life of rubber 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. For this product, the Reference Service Life (RSL) is 35 years. This means that the product will meet its functional requirements for an average of 35 years before replacement. Since the EPD must present results for both one-year and 60-year time periods, impacts are calculated for both time horizons. In the case of one-year results, the use phase impacts are based on the cleaning and maintenance model for one year. In the case of 60-year results, the production, transport, installation, and end-of-life are scaled to reflect replacements during the 60 year period; use phase impacts are scaled to represent maintenance for 60 years.

Cleaning and Maintenance

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.

Table 1: Cleaning Process

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

This cleaning process translates to:

Table 2: Cleaning Inputs

	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.

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 rubber 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.

Health Aspects During Usage

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 rubber flooring.

End of Life

Based on current best information a small amount of construction waste is incinerated or recycled, but for the purposes of this EPD 100% of all flooring removal waste is considered disposed of in a landfill.

Life Cycle Assessment

A full Life Cycle Assessment has been carried out according to ISO 14040 and 14044, per the Product Category Rule (PCR) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood, as published by NSF International (2012).

The following life cycle stages are considered:

- Product stage
- Construction stage
- Use stage
- End-of-life stage
- Benefits and loads beyond the product system boundary

The main purpose of EPDs is for use in business-to-business communication. As all EPDs are publicly available via the Program Operator and therefore are accessible to the end consumer, they can also be used in business-to-consumer communication.

Functional Unit Description

The declaration refers to the functional unit of $1m^2$ installed floor covering.

Cut-off Criteria

At a minimum, all raw materials representing 1% of input mass or greater were included. In order to satisfy the condition that neglected input flows shall be a maximum of 5% mass, material flows with a proportion of less than 1% were also considered so that ultimately, materials below the cut-off criteria accounted for no more than 5% of total input mass. For manufacturing, the water required for steam generation, the utilized thermal energy, the electrical energy, the required packaging materials, and all direct production waste were all included in the analysis.

Background Data

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

For life cycle modeling of the considered products, the GaBi 6 Software System for Life Cycle Engineering, developed by thinkstep AG, has been used to model the product systems considered in this assessment. All relevant background datasets are taken from the GaBi 2014 software database. The datasets from the GaBi database are documented in the online documentation (thinkstep 2015). To ensure comparability of results in the LCA, the basic data of GaBi database were used for energy, transportation and auxiliary materials.

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 and background data used.

Temporal Coverage

Foreground data are based on 1 year averaged data between 2010 and 2011. Background datasets are all based on data from the last 10 years (since 2004), with the majority of datasets based on data from 2010 or later.

Technological Coverage

The raw material inputs in the calculation for this EPD are based on annual total purchases divided by annual production.

Waste, emissions and energy use are based on measured data during the reference year.

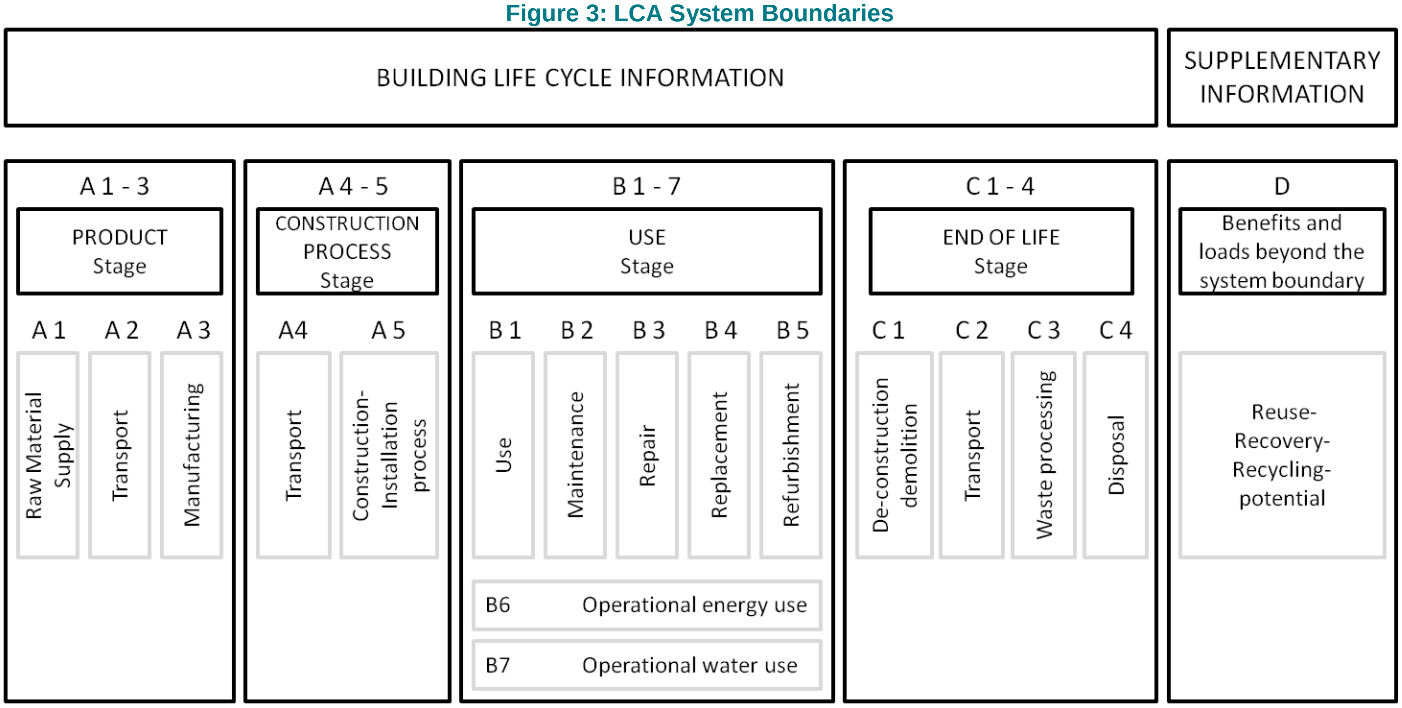
Geographical Coverage

In order 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.

System Boundaries

The system boundary of the EPD follows the modular design defined by EN 15804. The following pages describe the modules which are contained within the scope of this study in detail.

Figure 3: LCA System Boundaries

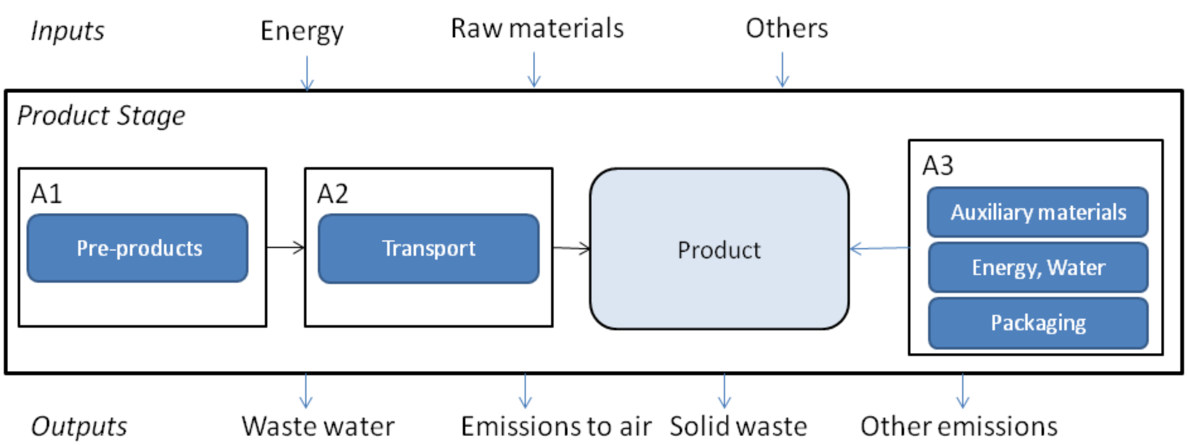


Impacts and aspects related to wastage (i.e. production, transport and waste processing and end-of-life stage of lost waste products and materials) are considered in the module in which the wastage occurs.

Product Stage

The following flowchart shown in Figure 4 represents the system boundaries for the product stage.

Figure 4: Schematic representation of the LCA system boundaries of the production stage (Modules A1-A3)



The product stage is an information module which must be contained in each EPD and includes:

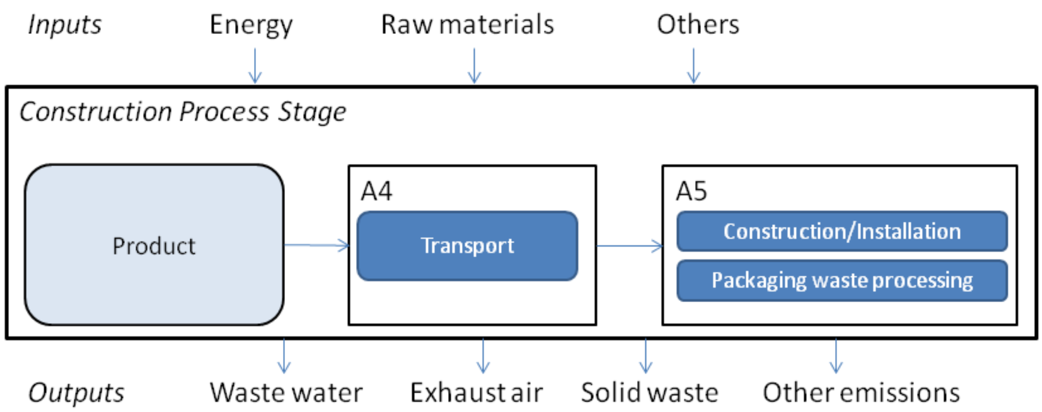
- A1 — raw material extraction and processing, processing of secondary material input (e.g. recycling processes)
- A2 — transport to the manufacturer and
- A3 — manufacturing.

This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of waste state or disposal of final residues during the product stage.

Construction Process

The following flowchart shown in Figure 5 represents the system boundaries for the construction stage.

Figure 5: Schematic representation of the LCA system boundaries of the construction stage (Modules A4-A5)



The construction process stage (delivery and installation) comprises:

- A4 — transport to the installation site and
- A5 — installation in the building.

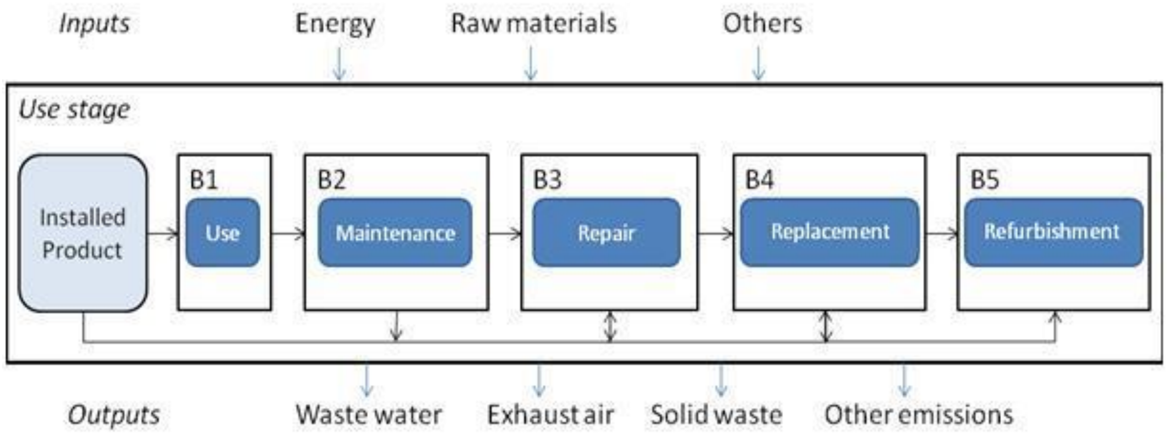
This includes provision of all materials, products and energy, as well as waste processing and disposal of waste created during the installation stage. These information modules also include all impacts and aspects related to any scrap materials generated during the installation.

In this study, transport 500 miles to installation site by truck and flooring installation in the building are included. For products manufactured outside of the US, transport by boat before shipping to installation site was also included.

Use

The following flowchart shown in Figure 6 represents the system boundaries for the use stage related to the building fabric. The processes B1, B3, and B5 are not relevant for the flooring and therefore not considered in this study.

Figure 6: Schematic representation of the LCA system boundaries of the use stage (Modules B1-B5)



The use stage, related to the building includes:

- B2 — maintenance;
- B4 — replacement;

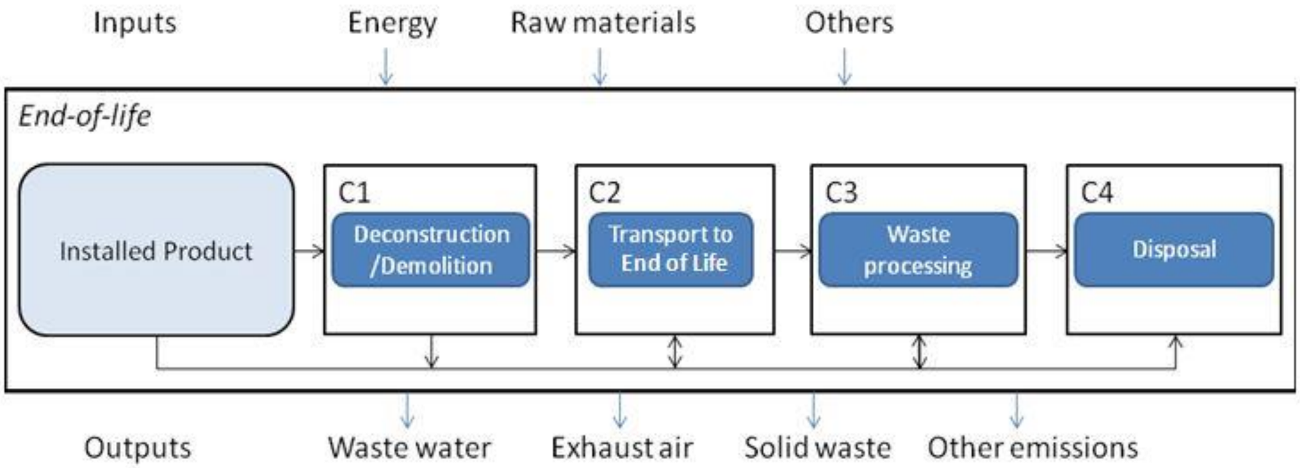
This includes provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during this part of the use stage. These information modules also include all impacts and aspects related to the losses during this part of the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

In this study the cleaning process (i.e., maintenance) consisting of dust mopping, damp mopping, and spray buffing is considered.

End-of-Life

The following flowchart shown in Figure 7 represents the system boundaries for the end-of-life stage:

Figure 7: Schematic representation of the LCA system boundaries of the end-of-life stage (Module C1-C4)



The end-of-life stage starts when the flooring product is removed from the building and does not provide any further function. This stage includes:

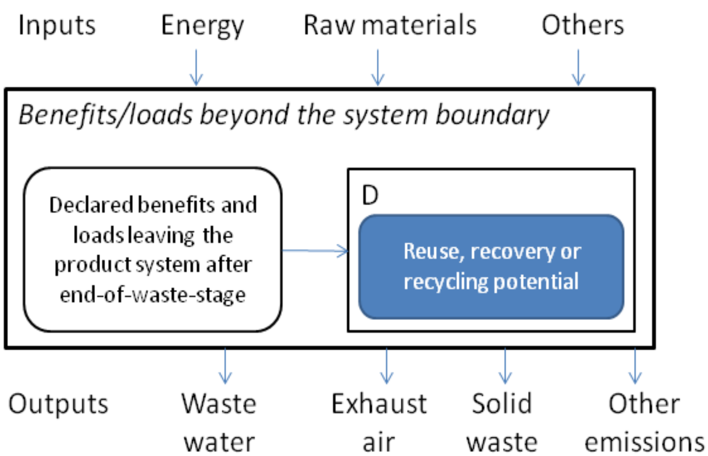
- C1 — de-construction, demolition:
- C2 — transport to waste processing;
- C3 — waste processing for reuse, recovery and/or recycling;
- C4 — disposal

This includes provision and all transports, provision of all materials, products and related energy and water use. Materials are assumed transported 20 miles by truck to disposal.

Benefits and Loads beyond the system boundary (Credits)

The flowchart shown in Figure 8 represents the benefits/loads beyond the system boundary. In particular, these credits include the benefit from capturing methane gas at landfills which can be used for electricity generation.

Figure 8: Schematic representation of the LCA system boundaries of the benefits and loads beyond the product system boundary (Module D)



This life cycle phase includes credits from all net flows that leave the product system boundary . Since the electricity generated from landfill gas combustion is utilized outside the flooring life cycle, a credit is applied (represented by negative emissions) for the displaced average US electricity grid mix.

Allocation

Co-Product Allocation

No co-product allocation occurs in the product system.

Multi-Input Processes Allocation

No multi-input allocation occurs in the product system.

Recovery Allocation

The cut-off allocation approach is adopted in the case of any post-consumer recycled content, which is assumed to enter the system burden-free. Only environmental impacts from the point of recovery and forward (e.g., collection, sorting, processing, etc.) are considered.

Product and packaging waste is modeled as being disposed in a landfill rather than incinerated or recycled. Plastic and other construction waste is assumed to be inert in landfills so no system expansion or allocation is necessary as landfill gas is not produced. In the case of bio-based packaging waste disposed during installation, landfill gas from the decomposition of this waste is assumed to be collected and used to produce electricity. It is assumed that this recovered energy offsets that are produced by the US average grid.

Results

It is important to note that results reported in the tables below represent an average of the three flooring manufacturers participating in this EPD based on the actual square meters produced by each manufacturer for sale in North America. Caution should be used when comparing the results presented in this EPD to the environmental performance of other rubber floor products as the thickness of floors and other factors of floors can influence the environmental impacts. Although the environmental impacts should be lower for the thinner floors (less raw materials), a thicker floor most often lasts longer, balancing the advantage gained by a thinner floor.

Life Cycle Inventory Analysis

Primary Energy Demand

Total primary energy results for one square meter installed rubber flooring are presented in Tables 3 and 4 for specific energy resources.

Table 3: Primary energy, non-renewable for all life cycle stages of 1 square meter of rubber flooring for one year

Non-Renewable Energy Resources	Units	Sourcing / Extraction	Manufacturing	Installation	Use (1-year)	End-of-Life	Total Life Cycle	Percentage of total (%)
Total resources	MJ	205	101	10.4	1.57	6.24	325	100%
Crude Oil	MJ	91.6	12.7	4.32	0.313	1.82	111	34%
Hard Coal	MJ	5.88	43.8	0.207	0.21	0.536	50.6	16%
Lignite	MJ	5.09	3.64	0.267	0.023	0.329	9.34	3%
Natural Gas	MJ	97.4	29.4	5.25	0.932	3.23	136	42%
Uranium	MJ	5.57	11.4	0.383	0.0951	0.319	17.8	5%

Table 4: Primary energy, renewable for all life cycle stages of 1 square meter of rubber flooring for one year

Renewable Energy Resources	Units	Sourcing / Extraction	Manufacturing	Installation	Use (1-year)	End-of-Life	Total Life Cycle	Percentage of total (%)
Total resources	MJ	6.68	9.53	1.63	0.0398	0.307	18.2	100%
Geothermal	MJ	0.0117	0.335	-5.94E-05	0.0026	0.00295	0.352	2%
Hydro power	MJ	0.707	2.6	0.0462	0.0151	0.0639	3.43	19%
Solar energy	MJ	4.78	4.34	1.52	0.0116	0.176	10.8	59%
Wind power	MJ	1.19	2.25	0.0654	0.0105	0.0639	3.58	20%

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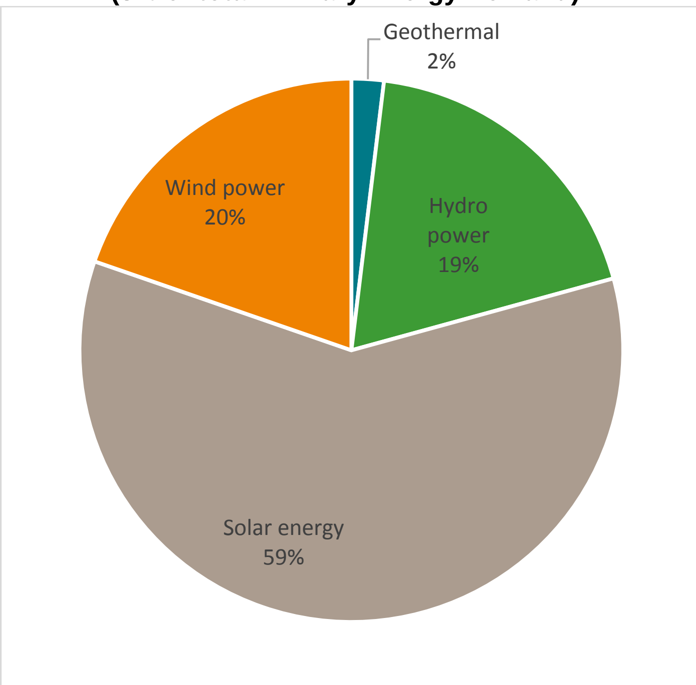
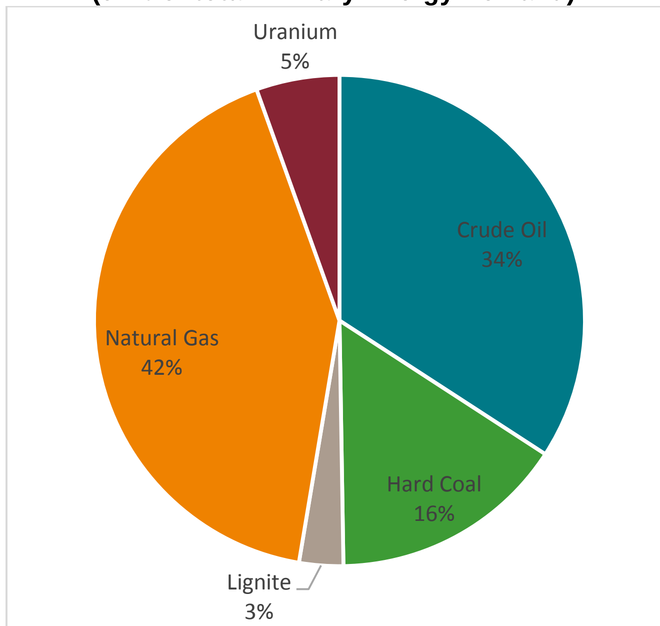
Rubber Floor Tile

According to ISO 14025

Renewable Primary Energy
(3% of total Primary Energy Demand)



Non-Renewable Primary Energy
(97% of total Primary Energy Demand)



Other Resources and Wastes

Secondary material and secondary fuel (fossil and renewable) consumption are presented in Table 5.

Table 5: Other resources and wastes for all life cycle stages of 1 square meter of rubber flooring for one year

	Units	Sourcing / Extraction	Manufacturing	Installation	Use (1-year)	End-of-Life	Total Life Cycle
Resources							
Non-renewable material	kg	14.7	11.6	0.594	0.0665	1.51	28.4
Secondary material	kg	0	0	0	0	0	0
Secondary fuel, fossil	MJ	0.0463	0.0305	0.00233	0.000784	0.00929	0.0892
Secondary fuel, renewable	MJ	0.00445	0.0034	0.000477	8.62E-05	0.00413	0.0125
Wastes							
Hazardous waste	kg	0	0	0	0	0	0
Non-hazardous waste	kg	9.99	12.2	0.777	0.0747	5.69	28.7
Radioactive waste	kg	0.00221	0.00449	0.000152	3.73E-05	0.000126	0.00702

Life Cycle Impact Assessment

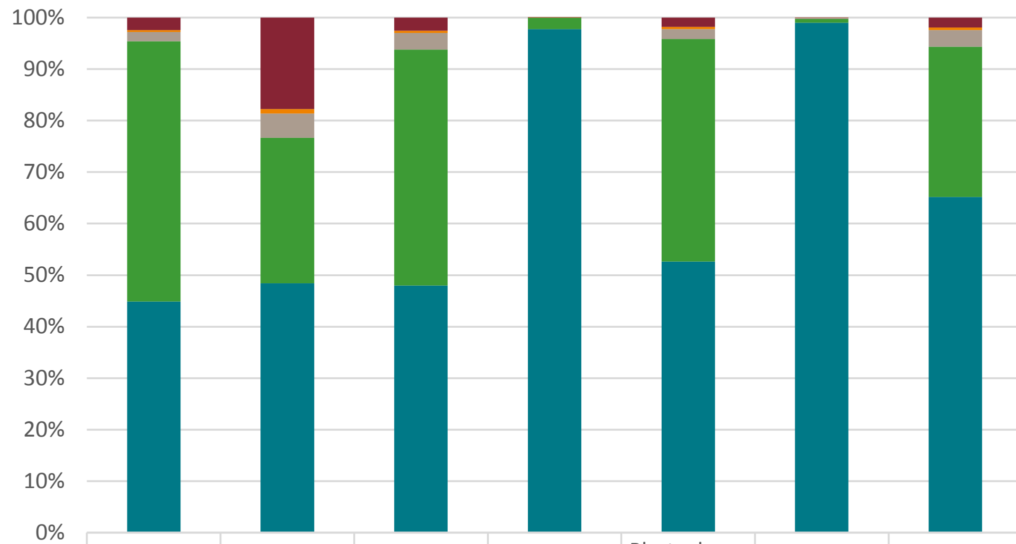
CML 2001 – April 2013 impact assessment results for 1-year use and 60-years use are presented in Table 6. Since the RSL for this product is 35 years, it must be produced 1.71 times in a 60 year period.

Table 6: Impact assessment results for all life cycle stages of one square meter of rubber flooring for 1-year and 60-year use

Impact Assessment Method: CML 2001 –April 2013	Units	Sourcing / Extraction	Manufacturing	Installation	Use	End-of-Life	Total Life Cycle
1-year Use							
Acidification Potential	kg SO_2-eq.	0.0241	0.0271	0.000962	0.000206	0.00131	0.0536
Eutrophication Potential	kg PO_4^{3-}-eq.	0.00384	0.00224	3.76E-04	6.93E-05	0.00141	0.00794
Global Warming Potential	kg CO_2-eq.	7.85	7.49	0.526	0.0791	0.415	16.4
Ozone Depletion Potential	kg R11-eq.	8.24E-07	1.88E-08	2.71E-11	9.63E-12	2.20E-11	8.43E-07
Photochem. Oxidant Formation Potential	kg Ethene-eq.	0.00463	0.0038	0.000169	3.94E-05	0.000158	0.0088
Abiotic Depletion, Elements	kg Sb-eq.	0.000141	1.06E-06	2.30E-07	7.47E-08	8.00E-08	0.000142
Abiotic Depletion, Fossil	MJ	200	89.4	10	1.48E+00	5.92	307
60-years Use							
Acidification Potential	kg SO_2-eq.	0.0412	0.0464	0.00165	0.0123	0.00224	0.104
Eutrophication Potential	kg PO_4^{3-}-eq.	0.00659	0.00384	6.44E-04	4.16E-03	0.00242	0.0177
Global Warming Potential	kg CO_2-eq.	13.5	12.8	0.902	4.75	0.711	32.7
Ozone Depletion Potential	kg R11-eq.	1.41E-06	3.23E-08	4.64E-11	5.78E-10	3.78E-11	1.45E-06
Photochem. Oxidant Formation Potential	kg Ethene-eq.	0.00794	0.00652	0.00029	2.37E-03	0.000272	0.0174
Abiotic Depletion, Elements	kg Sb-eq.	0.000242	1.82E-06	3.94E-07	4.48E-06	1.37E-07	0.000249
Abiotic Depletion, Fossil	MJ	343	153	17.2	8.87E+01	10.1	612

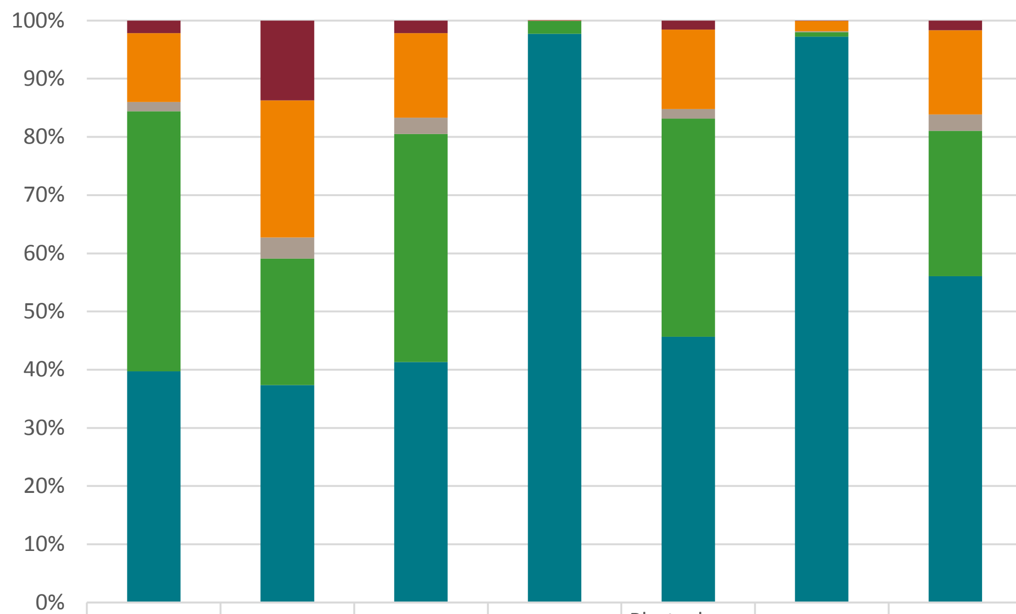
The impact assessment results are calculated using characterization factors published by the University of Leiden's CML 2001 – April 2013 as well as the US EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) version 2.1.

Figure 9: CML 2001 – April 2013 impact assessment results for 1-year use



	Acidification Potential	Eutrophication Potential	Global Warming Potential	Ozone Depletion Potential	Photochem. Oxidant Formation Potential	Abiotic Depletion, Elements	Abiotic Depletion, Fossil
End-of-Life	2%	18%	3%	0%	2%	0%	2%
Use (1-year)	0%	1%	0%	0%	0%	0%	0%
Installation	2%	5%	3%	0%	2%	0%	3%
Manufacturing	51%	28%	46%	2%	43%	1%	29%
Sourcing / Extraction	45%	48%	48%	98%	53%	99%	65%

Figure 10: CML 2001 – April 2013 impact assessment results for 60-years use



	Acidification Potential	Eutrophication Potential	Global Warming Potential	Ozone Depletion Potential	Photochem. Oxidant Formation Potential	Abiotic Depletion, Elements	Abiotic Depletion, Fossil
End-of-Life	2%	14%	2%	0%	2%	0%	2%
Use (60-year)	12%	24%	15%	0%	14%	2%	14%
Installation	2%	4%	3%	0%	2%	0%	3%
Manufacturing	45%	22%	39%	2%	37%	1%	25%
Sourcing / Extraction	40%	37%	41%	97%	46%	97%	56%

Table 7: CML 2001 – April 2013 and TRACI 2.1 impact assessment results for 1 square meter of rubber flooring - cumulative impacts after 1-year and 60-years

Impact Assessment Method: CML 2001 – April 2013			
Impact Category	**Units**	**1-year**	**60-years**
Acidification Potential	kg SO_2-eq.	0.0536	0.104
Eutrophication Potential	kg PO_4^{3-}-eq.	0.00794	0.0177
Global Warming Potential	kg CO_2-eq.	16.4	32.7
Ozone Depletion Potential	kg R11-eq.	8.43E-07	1.45E-06
Photochem. Oxidant Formation Potential	kg Ethene-eq.	0.0088	0.0174
Abiotic Depletion, Elements	kg Sb-eq.	0.000142	0.000249
Abiotic Depletion, Fossil	MJ	307	612
Impact Assessment Method: TRACI 2.1			
Impact Category	**Units**	**1-year**	**60-years**
Acidification Potential	kg SO_2-eq.	0.0552	0.109
Eutrophication Potential	kg N-eq.	0.00557	0.0164
Global Warming Potential	kg CO_2-eq.	16.4	32.7
Ozone Depletion Potential	kg CFC11-eq.	8.47E-07	1.45E-06
Smog Formation Potential	kg O_3-eq	0.838	1.6

Interpretation

When considering a 60 year product life, raw materials production and recommended maintenance are the two largest contributors in each impact category considered. The production of raw materials represents a substantial fraction of the life cycle impacts, even over the life of a building. The impacts associated with flooring maintenance add up over time, and are relevant contributors to the life cycle.

References

thinkstep 2015	GaBi 6 dataset documentation for the software-system and databases, LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2012 (http://documentation.gabi-software.com/)
EN 15804	EN 15804:2010-08 Sustainability of construction works -Environmental Product Declarations - Core rules for the product category of construction products
ISO 14025	ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040	ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements and guidelines
NSF PCR 2012	NSF Product Category Rule for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood

This LCA was conducted and EPD prepared by:

thinkstep