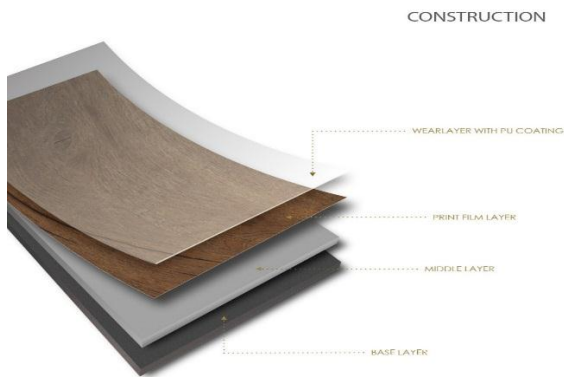


Environmental Product Declaration

PVC flooring (Thickness: 2.0 mm - 5.0 mm)



Company Information

- Company: Vinyl Tech Enterprise Co., Ltd.
- Address:
 - (1) Shan Jia factory: NO. 6, Ln 230, Gongyi Rd, Zhunan Township, Miaoli County 35048, Taiwan(R.O.C.)
 - (2) Gongguan factory: No.100, Gongguanwai, Zhunan Township, Miaoli County 35057, Taiwan(R.O.C.)
 - (3) Xin nan factory: No.32-5, Sanjiaodian, Zhunan Township, Miaoli County 350, Taiwan (R.O.C.) 35056
- Main products: vinyl tiles
- Website: <http://www.floorworks.net/>
- Contact: Product Development Jian-Wei Kung
- Tel: +886-37-613618 # 154
- Fax: +886-37-627755
- e-mail: kungbest@vinyltech.com.tw

Company Overview

- Vinyltech Enterprise Ltd. was founded in 1984 as an OEM for many well known international vinyl

flooring brands. In 2000, the company started FLOORWORKS as our global brand and global product distribution.

- Vinyl Tech is dedicated to creating healthy, safe and environment friendly living space, as well as achieving greatest benefits through using minimal resources.
- Vinyl Tech requires all employees to strive for controlling product quality, pursuing continuous innovation in providing highest customer satisfaction, and becoming a socially responsible company.

Product Functions

- Luxury Vinyl Tile (LVT) is a durable, aesthetic, and easy to install product, ideal for both commercial and residential applications.
- Three series of LVT: Wood, Tile and Creative.
- Thickness: 2.0 mm, 2.5 mm, 3.0 mm, 4.2 mm and 5.0 mm.

Product Performance

- The products considered in this EPD meet the following Technical Specifications:
- ASTM F 1700 – Standard Specification for Solid Vinyl Floor tiles: Class III, type B.
- ISO 10582 – Resilient floor coverings – Heterogeneous polyvinyl chloride floor covering – Specification: The products are classified from 23-31 to 34-43 according the references of the LVT.
- FloorScore® - Indoor Air Quality Certified to SCS-EC10.3-2014.

Fire Testing:

Bfl-s1 when tested in accordance with EN 13501-1, Standard Test Method for Critical Radiant Flux.

Additional Environmental Information

Relevant certifications:

- Indoor Air Comfort - pan-European product certification
- M1 label for air-handling components
- ISO 14001: 2015 Environmental management systems -- Requirements with guidance for use

Product Composition

composition	main material	Rate	Availability			Raw material origin
			Renewable	Nonrenewable	Recycling	
Polymer	Polyvinyl chloride	33.82%		Fossil limited		Taiwan
Filler	Calcium carbonate	52.12%		Mineral abundant		Taiwan
lacquer	Acrylic resin	1.00%		Fossil limited		Global
Pigment	Titanium dioxide	0.51%		Fossil limited		Taiwan
Plasticizer	Various	10.89%		Fossil limited		Global
Stabilizer	Various	0.66%		Fossil limited		Global
Other components	Various	1.00%		Fossil limited		Global

Main Materials

Polyvinyl chloride, calcium carbonate, stabilizer, petroleum resin, process aid, black masterbatch, DINCH (plasticizer), epoxidized soybean oil, ink and pigment, and coating.

Product Characteristics

Characteristics	Average Value	Unit	Maximum Value	Minimum Value
Product Thickness:	-	mm(inch)	5.0	2.0
Wear Layer Thickness:	-	mm(inch)	0.9	0.1
Product Weight:	3.96	Kg/m ² (oz/inch)		
Product Form:	Tiles	-	915x915 (36x36)	1305x305 (12x12)
	Planks	-	229x76 (9x3)	1219x228 (48x9)
VOC Emissions Test Method:	German AgBB / DIBt certification			
Additional Characteristics According to NSF/ANSI 332:	None			
Sustainable Certifications:	FloorScore® IAQ Certification			

Product Category Rules

Product Category Rule for Environmental Product Declarations Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International, 2014.

System Boundary for Life Cycle Inventory

Cradle-to-grave system boundary is used to facilitate communications with consumers, with the five life cycle stages below.



Geological Boundary

The life cycle environmental impacts for producing 1 m² of LVT (2 mm – 5 mm thickness) at the following three plants:

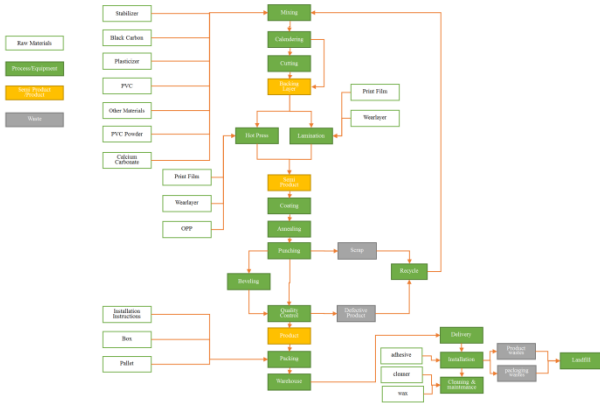
- (1) Shan Jia factory: NO. 6, Ln 230, Gongyi Rd, Zhunan Township, Miaoli County 35048, Taiwan(R.O.C.)
- (2) Gongguan factory: No.100, Gongguanwai, Zhunan Township, Miaoli County 35057, Taiwan(R.O.C.)
- (3) Xin nan factory: No.32-5, Sanjiaodian, Zhunan Township, Miaoli County 350, Taiwan (R.O.C.) 35056

Functional Unit

Functional unit: 1 m² of Luxury Vinyl Tile (LVT).

The environmental impacts have been calculated for 60 years of product use (assuming design product life of only 10 years), per the requirements of the PCR (Product Category Rule for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood, Version 2, NSF International, 2014.

Manufacturing Process



Material Acquisition/Processing Stage

This stage includes acquisition and processing of raw materials (including packaging materials), and their transportation from the suppliers. Also included are the consumption of materials, products and energy, as well the emissions to air, water and waste until the end-of-life stage. Data collection also covers the transportation information (mode of transportation and distance travelled).

Manufacturing Stage

This stage includes manufacturing of products using the raw materials. This includes provision of all materials, products and energy, as well as emissions to air and water and end-of-life waste disposal. Personnel related issues are not considered in this study. During the product manufacturing, the raw materials are mixed, heated and turned into sheet form. The sheets are then cut and laminated with a printed film. Some products are coated with a lacquer and annealed. Finally, the product is cut into tiles or planks and packaged. During each step of the production, quality control checks are made.

Product Delivery and Installation Stage

(1) Product delivery

This EPD considers both domestic transportation

(mainly by trucks) and overseas transportation (mainly by container ships) of products. The average transportation distance is estimated based on the actual ratio and type of product delivery and their transportation distance.

Adhesive required for installation: It is recommended that installation of 1m² of product requires 150 g of water-based acrylic adhesive, and 5% of the product will be cut off as scrap during the installation process. All such waste is assumed to be disposed of in landfill.

(2) Waste

During installation, 5% of product is turning into scrap/waste, which will be disposed of in landfill. All emissions are allocated to the installation process.

(3) Packaging materials

Type of Packaging	Material
pallet	wood
paper box	corrugated cardboard
shrink wrap	PE film
labels and instruction	paper
OPP tape	OPP
PVC tape	PVC
gloves	cotton

Use Stage

The product's reference service life (RSL) is ten (10) years before needed to be replaced, which is the warranty period offered by FLOORWORKS (<http://www.floorworks.net/>).

This EPD provides the impact results calculated for both 1-year and 60-year periods. The building with the products installed is assumed to have a life of 60 years.

Impacts for one year use stage are calculated from the initial installation (transportation and installation) of product, and annual cleaning and maintenance

activities.

The impacts for 60-year use stage are calculated for 1 M² of product with 6 replacements (including replacement product's manufacturing, transportation, installation and waste management) and 60 years of maintenance. The impacts from the use stage come mainly from cleaning and periodic maintenance activities.

Cleaning and maintenance

As product maintenance is closely related to the locations of product installation, estimation of impacts is based on average maintenance of typical installation for both commercial and residential applications.

Maintenance Activities	Cleaning Tool/supplies	Cleaning Frequency	Energy/resource Consumption
Dust removal	Mop	Daily	None
Dust removal	Mop/cleaner	Weekly	Water/neutral cleaner
Maintenance	Wax	Every 6 months	Electricity

Reference for cleaning and maintenance information:

- <http://www.floorworks.net/index.html>
- <http://www.dr-schutz.com/en/dr-schutz/private-consumers/produkt/pu-cleaner/>

End-of-Life Stage

This EPD assumed all end-of-life products are disposed of in landfill, and each diesel-powered dumpster truck travels 30 km to the landfill. This assumption was made as waste incineration and waste tile flooring recycling facilities are relatively rare in the product's major market, the U.S.A.

LCA Methods

The life cycle inventory was conducted based on the CML IA-Baseline and Cumulative Energy Demand methods.

Sources of Data:

Activity data name	Database	Coefficient name	Years
Polymer	USLCI	Polyvinyl chloride resin, at plant/kg/RNA	2008
Filler	ELCD	Calcium carbonate > 63 microns, production, at plant EU-27 S	2014
Filler	ELCD	Calcium carbonate > 63 microns, production, at plant EU-27 S	2014
Stabilizer	Ecoinvent 3	market for chemicals, inorganic GLO	2014
Stabilizer	Ecoinvent 3	market for chemicals, inorganic GLO	2014
Process acid	ELCD	Polymethyl methacrylate (PMMA) beads, production mix, at plant RER	2014
Process acid	ELCD	Polymethyl methacrylate (PMMA) beads, production mix, at plant RER	2014
Process acid	ELCD	Polymethyl methacrylate (PMMA) beads, production mix, at plant RER	2014
Pigment	Ecoinvent 3	market for carbon black GLO	2014
Pigment	Ecoinvent 3	market for titanium dioxide RER	2014
Plasticizer	Ecoinvent 3	market for chemical, organic GLO	2014
Plasticizer	Ecoinvent 3	market for soybean oil, crude GLO	2014
Lacquer	Ecoinvent 3	market for acrylic varnish, without water, in 87.5% solution state GLO	2014
glass fiber net	Ecoinvent 3	market for glass fibre GLO	2014

Results of LCIA

For the five life cycle stages of LVT, the following environmental impacts have been calculated using CML IA-baseline and Cumulative Energy Demand characterization methods.

Impact indicators	Unit	Raw material	Manufacture	Delivery and installation	Dispose	Total
Global warming potential 100 year time horizon	kg CO ₂ eq	4.9	1.7	0.9	0.1	7.6
Acidification	kg SO ₂ eq	5.0x10 ⁻²	5.5x10 ⁻³	1.2x10 ⁻²	3.2x10 ⁻⁵	6.7x10 ⁻²
Ozone depletion potential	Kg CFC-11 eq	3.7x10 ⁻⁷	1.3x10 ⁻⁷	1.4x10 ⁻⁷	8.3x10 ⁻¹⁰	6.4x10 ⁻⁷
Photochemical oxidation	Kg C ₂ H ₄	2.9x10 ⁻³	2.7x10 ⁻⁴	5.8x10 ⁻⁴	3.2x10 ⁻⁵	3.8x10 ⁻³
Eutrophication	kg PO ₄ ³⁻ eq	5.8x10 ⁻³	2.1x10 ⁻³	2.1x10 ⁻³	6.7x10 ⁻⁴	1.1x10 ⁻²
Abiotic depletion, elements	kg Sb eq	7.7x10 ⁻⁶	5.6x10 ⁻⁷	2.8x10 ⁻⁶	5.2x10 ⁻⁹	1.1x10 ⁻⁵
Abiotic depletion, fossil fuels	MJ	121.3	21.8	14.3	7.4x10 ⁻²	157.5
Renewable Energy	MJ eq	6.8	0.5	0.6	4.5x10 ⁻³	7.9
Non-renewable Energy	MJ eq	124.5	25.1	15.2	8.6x10 ⁻²	164.9

Use stage environmental impact for 1 m² LVT (in one year)

Impact indicators	Unit	Use and maintenance
Global warming potential 100 year time horizon	kg CO ₂ eq	0.2
Acidification	kg SO ₂ eq	2.9x10 ⁻³
Ozone depletion potential	kg CFC-11 eq	2.7x10 ⁻⁸
Photochemical oxidation	Kg C ₂ H ₄	6.6x10 ⁻⁵
Eutrophication	kg PO ₄ ³⁻ eq	7.8x10 ⁻⁴
Abiotic depletion, elements	kg Sb eq	6.3x10 ⁻⁷
Abiotic depletion, fossil fuels	MJ	5.9
Renewable Energy	MJ eq	0.5
Non-renewable Energy	MJ eq	6.2

Life cycle environmental impacts for FLOORWORKS LVT for 60-year of use

Impact indicators	Unit	Raw material	Manufacture	Delivery and installation	Use	Dispose	Total
Global warming potential 100 year time horizon	kg CO ₂ eq	29.3	10.3	5.6	13.4	0.7	59.3
Acidification	kg SO ₂ eq	0.3	3.3x10 ⁻²	6.9x10 ⁻²	0.2	2x10 ⁻⁴	0.6
Ozone depletion potential	kg CFC-11 eq	2.2x10 ⁻⁶	8.0x10 ⁻⁷	8.2x10 ⁻⁷	1.4x10 ⁻⁶	5.0x10 ⁻⁹	5.3x10 ⁻⁶
Photochemical oxidation	Kg C ₂ H ₄	1.8x10 ⁻²	1.6x10 ⁻³	3.5x10 ⁻³	3.5x10 ⁻³	1.9x10 ⁻⁴	2.6x10 ⁻²
Eutrophication	kg PO ₄ ³⁻ eq	3.5x10 ⁻²	1.3x10 ⁻²	1.2x10 ⁻²	4.5x10 ⁻²	4.0x10 ⁻³	0.1
Abiotic depletion, elements	kg Sb eq	4.6x10 ⁻⁵	3.4x10 ⁻⁶	1.7x10 ⁻⁵	3.1x10 ⁻⁵	3.1x10 ⁻⁸	9.8x10 ⁻⁵
Abiotic depletion, fossil fuels	MJ	728.1	130.9	85.8	305.4	0.4	1250.6
Renewable Energy	MJ eq	40.9	3.0	3.4	28.2	2.7x10 ⁻²	75.6
Non-renewable Energy	MJ eq	747.2	150.7	91.1	325.7	0.5	1315.1

- Wood, Version 2, NSF International, 2014
- ISO 21930: 2007 Sustainability in building construction – Environmental declaration of building products
 - ASTM F 1700 – Standard Specification for Solid Vinyl Floor tiles
 - ISO 10582 – Resilient floor coverings – Heterogeneous polyvinyl chloride floor covering – Specification
 - ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux
 - ASTM E 662/NFPA 258, Standard Test Method for Smoke Density
 - Environmental Product Declaration, Karndean Designflooring LLC.

References

- ISO 14025: 2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures
- ISO 14040: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines
- ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines
- Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic,