Environmental Product Declaration

Karndean Designflooring | Korlok Rigid Core Luxury Vinyl flooring

VERIFIED by SCS GLOBAL SERVICES
ENVIRONMENTAL PRODUCT DECLARATION
BASED ON LCA

Declaration Owner

Karndean Designflooring
Crab Apple Way, Vale Park, Evesham
Worcestershire, WR11 1GP
United Kingdom
www.karndean.com

Product

Korlok Rigid Core Luxury Vinyl flooring
EPD represents delivery of product to customers in North America, the United Kingdom and Australasia

Functional Unit

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

EPD Number and Period of Validity

SCS-EPD-05830
EPD Valid November 26, 2019 through November 25, 2024

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

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

SCSglobal SERVICES

Declaration Owner:	Karndean Designflooring
Address:	Crab Apple Way, Vale Park, Evesham, Worcestershire, WR11 1GP, United Kingdom
Declaration Number:	SCS-EPD-05830
Declaration Validity Period:	November 26, 2019 through November 25, 2024
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell, Ph.D., SCS Global Services
LCA Software and LCI database:	SimaPro 8.3 software and the Ecoinvent v3.3 database
Product RSL:	30 years
Markets of Applicability:	North America; United Kingdom; Australia
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Grave
LCIA Method and Version:	CML-IA and TRACI 2.1
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Part A 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
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2. UL Environment. May 2018.
Part B PCR Review conducted by:	Jack Geibig (chair), Ecoform; Thomas Gloria, Industrial Ecology Consultants; Thaddeus Owen
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

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.

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1. Karndean Designflooring

Karndean Designflooring is a global leader in flooring design with operations in the UK, USA, Australia and New Zealand. By offering a wide range of colours, textures and finishes, our products allow you to create looks that are unique to your home or business and are guaranteed to last. With a passion for creating floors which are both stylish and practical, we're here to help customers find the right floor for their space, needs and unique style.

At Karndean, we see flooring differently. From the ancient forests of Europe, to the remote Australian outback and beyond, we seek out expressive and intriguing forms in the natural world to influence our unique floor designs. By combining these original features with cutting edge design, we create simply beautiful floors that you'll love for a lifetime.

2. Product

2.1 PRODUCT DESCRIPTION

Korlok, one of Karndean Designflooring's Rigid Core ranges, is suitable for both commercial and residential interiors; achieving classifications 21, 22, 23, 31, 32, 33 according to EN ISO 10874. The product is structured into a number of layers, as shown in the diagram below, and comprises a rigid core to assist with installation over uneven subfloors, and a pre-attached acoustic backing specifically engineered to give excellent acoustic properties; reducing noise transfer to rooms below.

*5G® is a patented technology invented by Välinge Innovation AB. The 5G® word mark and logo are registered trademarks owned by Välinge Innovation AB and any use of such marks is under license.

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 Korlok products provide the primary function of flooring for interior applications. Korlok 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	B1	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 = Module Included | MND = Module Not Declared

2.5 TECHNICAL DATA

Technical specifications for the Korlok products are summarized in Table 2.

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Table 2. *Product specifications for the Korlok product.*

Product Characteristics			Nominal value	Unit	Maximum value	Minimum value
Product thickness			6.50 (0.256)	mm (inch)	6.63 (0.261)	6.40 (0.252)
Wear layer thickness			0.55 (0.022)	mm (inch)	0.62 (0.024)	0.50 (0.020)
Product weight			7,480 (24.51)	g/m^2 (oz./ft^2)	8,452 (27.69)	6,732 (22.06)
VOC emissions test method			FloorScore®; Indoor Air Comfort Gold			
Sustainable certifications			ISO 14001; CE			
Product Form	Tiles	width	225 (8.86)	mm (inch)	225.25 (8.87)	224.75 (8.85)
		length	1,420 (55.91)	mm (inch)	1,420.5 (55.93)	1,419.5 (55.89)

2.6 MARKET PLACEMENT/APPLICATION RULES

Technical specifications of the Korlok products are summarized below. Detailed product performance results can be found on the manufacturer's website www.karndean.com/technicaldatasheets.

- EN 16511:2014 - Loose-laid panels. Semi-rigid multilayer modular floor covering (MMF) panels with wear resistant top layer
- EN ISO 10874:2012 - Resilient, Laminate and Textile Floor coverings. Classification
- European standard EN 14041:2004 - Resilient, Textile and Laminate Floor coverings; Essential Characteristics EU Construction Products Regulation 305/2011
- ASTM F3261-17: Standard Specification for Resilient Flooring in Modular Format with Rigid Polymeric Core

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The Korlok products are delivered for installation in the form of planks (1420mm x 225mm).

2.8 MATERIAL COMPOSITION

The primary materials include polyvinyl chloride (PVC), plasticizers, fillers and various stabilizers and coatings.

Table 3. *Material content for the Korlok products, per square meter.*

Component	Material	kg	Percent
Calcium carbonate	Filler - natural, ground $CaCO_3$	3.60	48.1%
PVC	Polyvinyl chloride	3.02	40.4%
Plastics	Polyurethane; polyethylene	0.399	5.34%
Plasticizer	Plasticizer – DOTP mixture	0.289	3.86%
Additives	Various	0.128	1.71%
Stabilizer	Ba-Zn organic liquid complex; zinc oxide	$3.43x10^{-2}$	0.46%
Pigment	Carbon black; iron oxide; ink	$1.10x10^{-2}$	0.15%
Product total*		**7.48**	**100%**

**totals have been rounded to 3 significant figures*

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

2.9 MANUFACTURING

Karndean's vinyl tile flooring is produced at their manufacturing facility in China. The vinyl flooring is made primarily from polyvinyl chloride (PVC), calcium carbonate (mineral reinforcement), plasticizers and additives (i.e., pigments and stabilizers). The product includes a rigid core and is structured with multiple layers including PVC backing layers, a high definition photographic layer, a PVC wear layer and a polyurethane (PU) protective layer.

The production of vinyl tile flooring involves the following general manufacturing processes:

- Polyvinyl chloride resins are mixed with calcium carbonate, plasticizers, and pigments in a large industrial mixer.
- The core is extruded to a dough-like consistency. The dough-like substance is then put through calendar rollers and squeezed into sheets.
- The LVT sheets are embossed, PU coated, adhered to the core and then cut into individual planks, profiled, a foamed backing layer adhered and then packaged for shipment.

2.10 PACKAGING

The Karndean products are packaged for shipment using cardboard cartons, plastic wrap and wooden pallets.

Table 4. *Material content for the Korlok product packaging, per square meter.*

Component	Material	kg	%
Packaging	Corrugated board	0.188	46.3%
Packaging	Wood pallet	0.203	50.0%
Packaging	Plastic strapping	$9.53x10^{-3}$	2.35%
Packaging	Stretch wrap	$5.64x10^{-3}$	1.39%
Packaging total*		**0.406**	**100%**

**totals have been rounded to 3 significant figures*

2.11 PRODUCT INSTALLATION

Installation of the product is accomplished using hand tools with negligible impacts and waste. 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 product is 30 years.

2.14 RE-USE PHASE

The flooring products are not reused at end-of-life.

2.15 DISPOSAL

At end-of-life, the products may be disposed of in a landfill or via incineration. Although in some instances vinyl flooring can be recycled into other products, the practice is not typical, nor widely available as a disposal route for the products in the consumer markets considered. It is assumed that no components of the product are recycled at end-of-life.

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2.16 FURTHER INFORMATION

Further information on the product can be found on the manufacturer's website at www.karndean.com.

3. LCA: Calculation Rules

3.1 FUNCTIONAL UNIT

The functional unit used in the study is defined as 1 m^2 of floor covering installed for use over a 75-year period. The corresponding reference flow for the product system is 7.48 kg/m^2. The manufacturer declares a 15-year commercial warranty and lifetime residential warranty for their products defining the lifetime as 35 years for the UK, US and Australia. For the present assessment, a reference service lifetime (RSL) of 30 years is assumed based on the manufacturer's recommendation and consistent with similar, industry-wide LCAs[1]. The 30-year RSL leads to a total of two and one-half (2.5) product lifecycles during the 75-year period over which the product system is modeled.

Table 5. *Functional unit and reference flow for the Korlok product.*

Parameter	Value	Unit
Functional unit	1.00	m^2
Product weight per declared unit	7.48	kg/m^2

[1] RFCI_103.1_EPD_Rigid_Core_Flooring_Sept2018.docx

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 Korlok products.*

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 vinyl flooring components.
A2	Transport (to the manufacturer)	Transport of component materials to the manufacturing facilities
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	Installation of product is accomplished using hand tools with no associated emissions and 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, including periodic cleaning.
B3-B5	Product repair, replacement and refurbishment	The flooring is not expected to require repair or replacement over its lifetime. Impacts from these phases have negligible impact
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 incineration and/or landfilling which require no waste processing
C4	Disposal	Disposal of flooring product in municipal landfill or incineration
D	Reuse-recovery-recycling potential	Module Not Declared

**This includes unit processes involved in the generation of electricity, and production of ancillary material input (i.e., adhesives and pigments).*

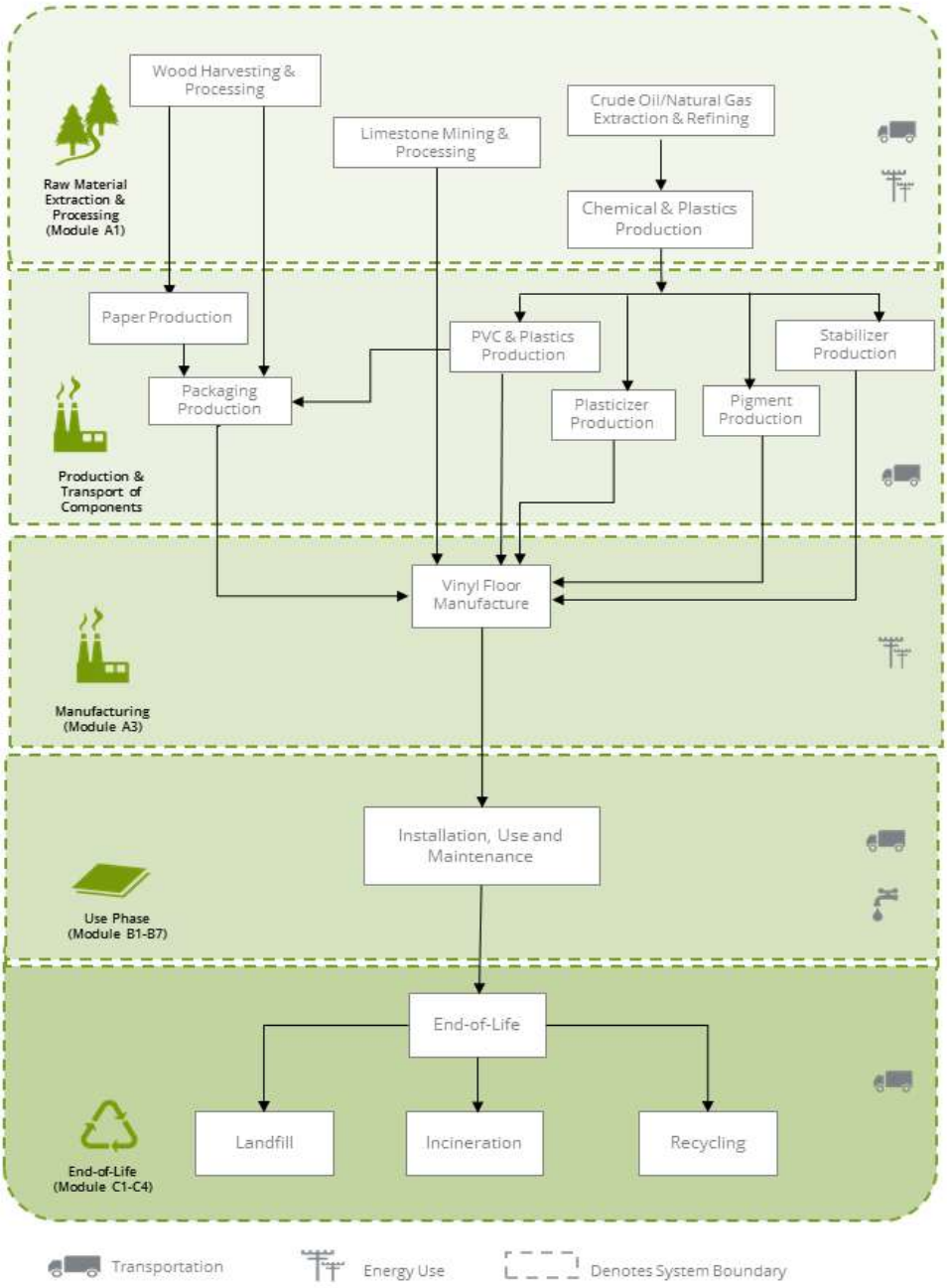

Figure 1. *Flow Diagram for the life cycle of the Korlok product system.*

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

- The Karndean facility is located in China. An Ecoinvent inventory dataset for the Chinese energy grid mix was used to model resource use and emissions from electricity use at the Karndean manufacturing facility.
- Life cycle inventory data for the plasticizer, a dioctyl terephthalate (DOTP) mixture, were not available. An inventory dataset for similar common plasticizers were developed using chemical process data from Overcash and Ecoinvent v3.3 unit process datasets. Inventory data developed for diisoheptyl phthalate (DIHP) was used as a surrogate to represent DOTP in the LCA model.
- It is assumed that no components of the product are recycled at end-of-life. Disposal of the product packaging is modeled based on regional statistics regarding municipal solid waste generation and disposal in the United Kingdom, the United States and Australia. The data include end-of-life recycling rates of packaging materials.
- For final disposal of the packaging material and vinyl flooring at end-of-life, all materials are assumed to be transported ~32 km (20 miles) by diesel truck to either a landfill, incineration facility, 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

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3.7 DATA SOURCES

Primary data were provided by Karndean for their manufacturing facilities. The sources of secondary LCI data are the Ecoinvent database.

Table 7. *Data sources for the Korlok product system.*

Component	Material Description	Material Dataset	Data Source	Publication Date
PRODUCT COMPONENT				
$CaCO_3$	Mineral reinforcement	Limestone, crushed, washed {RoW}| market for limestone, crushed, washed | Alloc Rec	EI v3.3	2016
PVC	Polyvinyl chloride	Polyvinylchloride, bulk polymerised {GLO}| market for | Alloc Rec	EI v3.3	2016
Plastics	LDPE	Polyethylene, low density, granulate {RER}| production | Alloc Rec	EI v3.3	2016
	PUR	Polyurethane, flexible foam {RER}| production | Alloc Rec	EI v3.3	2016
Plasticizer	Plasticizer (DOTP mixture)	Diisoheptyl phthalate (DIHP) {GLO} | market for | Alloc Rec	EI v3.3	2016
Organic chemicals	Organic chemicals	Chemical, organic {GLO}| market for | Alloc Rec	EI v3.3	2016
Inorganic chemicals	Inorganic chemicals	Chemical, inorganic {GLO}| market for chemicals, inorganic | Alloc Rec	EI v3.3	2016
Stabilizers	Zinc oxide	Zinc oxide {RER}| production | Alloc Rec	EI v3.3	2016
	Ba-Zn complex	Ba-Zn stearate (stabilizer) /kg	EI v3.3; MSDS	2016
Pigments	Pigments	Carbon black {GLO}| production | Alloc Rec	EI v3.3	2016
		Chemical, inorganic {GLO}| market for chemicals, inorganic | Alloc Rec	EI v3.3	2016
Other	Ethyl acetates	Ethyl acetate {RER}| production | Alloc Rec	EI v3.3	2016
	Polymers	Methyl acrylate {GLO}| production | Alloc Rec	EI v3.3	2016
	$NaHCO_3$	Sodium carbonate from ammonium chloride production, at plant/GLO	EI v3.3	2016
PACKAGING				
Packaging	Corrugated board	Corrugated board box {GLO}| market for corrugated board box | Alloc Rec	EI v3.3	2016
Packaging	Wood pallet	Wood pallet (22kg)/ RER	EI v2.2	2015
Packaging	Packaging plastic	Polyethylene, low density, granulate {RER}| production | Alloc Rec	EI v3.3	2016
Packaging	Stretch wrap	Packaging film, low density polyethylene {RoW}| production | Alloc Rec	EI v3.3	2016
TRANSPORTATION				
Road transport	Diesel Truck	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | Alloc Rec	EI v3.3	2016
Rail transport	Freight train	Transport, freight train {CN}| market for | Alloc Rec	EI v3.3	2016
Ship transport	Diesel Truck	Transport, freight, sea, transoceanic ship {GLO}| market for | Alloc Rec	EI v3.3	2016
RESOURCES				
Electricity	Grid electricity	Electricity, medium voltage {CN}| market group for | Alloc Rec	EI v3.3	2016
Heat	Fuel oil	Heat, district or industrial, other than natural gas {RoW}| heat production, light fuel oil, at industrial furnace 1MW | Alloc Rec	EI v3.3	2016
Heat	Coal	Heat, district or industrial, other than natural gas {RoW}| heat production, at hard coal industrial furnace 1-10MW | Alloc Rec	EI v3.3	2016
Heat	Biomass	Heat, district or industrial, other than natural gas {GLO}| heat production, straw, at furnace 300kW | Alloc Rec	EI v3.3	2016

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 Karndean Korlok product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 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 annualized production for 2018.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative data for China. 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.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative fabrication datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: 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.
Completeness: 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.
Representativeness: 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.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.3 data where available. Different portions of the product life cycle are equally considered; however, it must be noted that final disposition of the product is based on assumptions of current average practices in the United States, the United Kingdom and Australia.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at Karndean's facility in China represent 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 datasets, Ecoinvent v2.2 and v3.3 LCI data are used, with a bias towards Ecoinvent v3.3 data.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the flooring products and packaging is low. Actual supplier data for upstream operations was not available for all suppliers 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 is calendar year 2018.

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 product distribution centers are summarized in Table 5. 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. *Transport parameters (A4)*

Parameter	Transport distance			Unit
	North America	United Kingdom	Australia	
Transport distance *(diesel truck)*	200	217	200	km
Transport distance *(ocean freighter)*	18,000	17,667	10,000	km
Gross mass of products transported	7.48	7.48	7.48	kg

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

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 buffing of the vinyl flooring. The present assessment is based on a recommended weekly cleaning schedule including sweeping and damp mopping with a neutral cleaner and monthly buffing.

Table 10. *Maintenance parameters for the flooring products, per 1 m^2*

Parameter	Value	Unit
Maintenance process	Damp mopping	-
Maintenance cycle	1,560	Cycles / RSL
Maintenance cycle	3,900	Cycles / ESL
Net freshwater consumption	0.00591	$m^3/m^2/yr$
Cleaning agent	0.0197	$kg/m^2/yr$
Further assumptions	Moderate traffic weekly maintenance	-

Repair/Replacement/Refurbishment stage (B3 - B5)

Product repair, replacement and refurbishment are not relevant during the lifetime of the product. Based on the RSL of 30 years, a total of one and one-half (1.5) product replacements are required over the 75-yr ESL.

Parameter	Value	Unit
Reference Service Life (RSL)	30	years
Replacement Cycle (ESL/RSL-1)	1.5	-

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 or is burned in an incinerator (*C4*). For the Korlok flooring products, no emissions are generated during demolition (*C1*) while no waste processing (*C3*) is required for incineration or 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 regional statistics regarding municipal solid waste generation and disposal in the United States for 2015, from the US Environmental Protection Agency, national waste disposal statistics for the United Kingdom for 2017 and national waste disposal statistics for Australia for 2016. The data include end-of-life recycling rates of packaging and product materials. No recycling of the product materials is assumed at end-of-life. The relevant disposal statistics used for the packaging are summarized in Table 11 and Table 12.

Table 11. *Disposal routes for product materials at end-of-life.*

Material	North America	United Kingdom	Australia
Disposal of Non-recyclables			
Incineration	20%	26%	20%
Landfill	80%	74%	80%

Table 12. *Recycling rates for packaging materials at end-of-life.*

Material	North America	United Kingdom	Australia
Recycling Rates			
Paper and pulp	78.2%	79.0%	60%
Plastics	14.5%	46.2%	12%
Wood	26.1%	31.4%	39.8%
Disposal of Non-recyclables			
Incineration	20.0%	45.0%	20.0%
Landfill	80.0%	55.0%	80.0%

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:

Impact Category	Unit
Global Warming Potential (GWP 100)	kg CO_2 eq
Acidification Potential (AP)	kg SO_2 eq
Eutrophication Potential (EP)	kg N eq
Ozone Depletion Potential (ODP)	kg CFC 11 eq
Smog Formation Potential (SFP)	kg O_3 eq
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil})	MJ Surplus, LHV

The environmental impact category indicators are also reported based on the CML-IA characterization factors:

Impact Category	Unit
Global Warming Potential (GWP 100)	kg CO_2 eq
Acidification Potential (AP)	kg SO_2 eq
Eutrophication Potential (EP)	kg $(PO_4)^{3-}$ eq
Ozone Depletion Potential (ODP)	kg CFC 11 eq
Photochemical Oxidant Creation Potential (POCP)	kg C_2H_4 eq
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ, LHV

Table 13. *Life Cycle Impact Assessment (LCIA) results for the Korlok product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. (North America)*

	Module	A1	A2	A3	A4	A5	B1	C2	C4
Impact category	**Unit**	Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use & Maintenance	Transport	Disposal
CML-IA									
Global Warming Potential (GWP 100)	kg CO_2 eq	22.3	1.94	6.63	7.33	0.512	7.09	1.95	10.9
	%	38%	3.3%	11%	13%	0.87%	12%	3.3%	19%
Acidification Potential (AP)	kg SO_2 eq	$7.08x10^{-2}$	$1.08x10^{-2}$	$3.75x10^{-2}$	$9.66x10^{-2}$	$3.68x10^{-4}$	$2.48x10^{-2}$	$9.31x10^{-3}$	$3.05x10^{-3}$
	%	28%	4.3%	15%	38%	0.15%	9.8%	3.7%	1.2%
Eutrophication Potential (EP)	kg $(PO_4)^{3-}$ eq	$1.43x10^{-2}$	$2.40x10^{-3}$	$7.05x10^{-3}$	$1.16x10^{-2}$	$1.91x10^{-3}$	$1.74x10^{-2}$	$1.96x10^{-3}$	$5.47x10^{-2}$
	%	13%	2.2%	6.3%	10%	1.7%	16%	1.8%	49%
Ozone Depletion Potential (ODP)	kg CFC-11 eq.	$4.35x10^{-7}$	$2.83x10^{-7}$	$8.10x10^{-8}$	$1.25x10^{-6}$	$1.15x10^{-8}$	$2.81x10^{-7}$	$3.55x10^{-7}$	$5.91x10^{-8}$
	%	16%	10%	2.9%	45%	0.42%	10%	13%	2.1%
Photochemical Oxidant Creation Potential (POCP)	kg C_2H_4 eq	$4.04x10^{-3}$	$4.40x10^{-4}$	$1.71x10^{-3}$	$3.27x10^{-3}$	$1.11x10^{-4}$	$3.70x10^{-3}$	$3.68x10^{-4}$	$1.27x10^{-3}$
	%	27%	2.9%	11%	22%	0.74%	25%	2.5%	8.5%
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq	$1.53x10^{-5}$	$4.59x10^{-6}$	$1.82x10^{-6}$	$1.08x10^{-5}$	$4.97x10^{-8}$	$1.14x10^{-5}$	$1.30x10^{-6}$	$4.57x10^{-7}$
	%	33%	10%	4.0%	24%	0.11%	25%	2.8%	1.0%
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	528	27.6	59.8	111	1.02	33.5	29.6	6.10
	%	66%	3.5%	7.5%	14%	0.13%	4.2%	3.7%	0.77%
TRACI 2.1									
Global Warming Potential (GWP 100)	kg CO_2 eq	21.9	1.93	6.45	7.30	0.420	7.04	1.95	9.81
	%	39%	3.4%	11%	13%	0.74%	12%	3.4%	17%
Acidification Potential (AP)	kg SO_2 eq	$7.35x10^{-2}$	$1.22x10^{-2}$	$3.70x10^{-2}$	$9.94x10^{-2}$	$4.52x10^{-4}$	$2.54x10^{-2}$	$1.13x10^{-2}$	$3.73x10^{-3}$
	%	28%	4.6%	14%	38%	0.17%	9.7%	4.3%	1.4%
Eutrophication Potential (EP)	kg N eq	$2.13x10^{-2}$	$3.01x10^{-3}$	$1.30x10^{-2}$	$1.10x10^{-2}$	$5.11x10^{-3}$	$3.59x10^{-2}$	$1.59x10^{-3}$	0.146
	%	9.0%	1.3%	5.5%	4.6%	2.2%	15%	0.67%	62%
Ozone Depletion Potential (ODP)	kg CFC-11 eq	$4.35x10^{-7}$	$2.83x10^{-7}$	$7.88x10^{-8}$	$1.25x10^{-6}$	$1.15x10^{-8}$	$2.80x10^{-7}$	$3.55x10^{-7}$	$5.91x10^{-8}$
	%	16%	10%	2.9%	45%	0.42%	10%	13%	2.1%
Smog Formation Potential (SFP)	kg O_3 eq	1.23	0.270	0.356	1.61	$1.07x10^{-2}$	0.238	0.310	$7.70x10^{-2}$
	%	30%	6.6%	8.7%	39%	0.26%	5.8%	7.5%	1.9%
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil})	MJ surplus	71.0	3.38	2.38	14.8	0.139	2.98	4.18	0.749
	%	71%	3.4%	2.4%	15%	0.14%	3.0%	4.2%	0.75%

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Table 14. *Resource use, waste and outflows for the Korlok product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. (North America)*

Impact category	Unit	A1 Raw material extraction and processing	A2 Transport to manufacturer	A3 Manufacturing	A4 Transport	A5 Construction - installation	B1 Use & Maintenance	C2 Transport	C4 Disposal
Resource Use									
Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ	12.6	0.705	17.9	2.03	$1.40x10^{-2}$	44.0	0.127	0.266
	%	16%	0.91%	23%	2.6%	0.02%	57%	0.16%	0.34%
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0	0	0	0	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ.	INA	INA	INA	INA	INA	INA	INA	INA
Use of secondary materials	kg	0	0	1.1	0	0	0	0	0
	%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	0.00%	0.00%
Use of renewable secondary fuels	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Use of non-renewable secondary fuels	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Use of net fresh water	m^3	4.03	$3.53x10^{-2}$	0.174	0.115	$1.07x10^{-3}$	1.07	$1.02x10^{-2}$	$2.70x10^{-2}$
	%	74%	0.65%	3.2%	2.1%	0.02%	20%	0.19%	0.49%
Waste Flows									
Non-hazardous waste disposed	kg	$4.72x10^{-5}$	$2.27x10^{-5}$	$5.31x10^{-5}$	$6.26x10^{-5}$	$5.04x10^{-7}$	$5.82x10^{-5}$	$9.61x10^{-6}$	$1.40x10^{-5}$
	%	18%	8.5%	20%	23%	0.19%	22%	3.6%	5.2%
Hazardous waste disposed	kg	1.48	0.921	1.95	2.44	0.697	0.504	0.120	15.2
	%	6.4%	4.0%	8.4%	10%	3.0%	2.2%	0.52%	65%
Radioactive waste disposed (high-level)	kg	$1.31x10^{-5}$	$2.64x10^{-6}$	$8.48x10^{-6}$	$1.26x10^{-5}$	$5.99x10^{-8}$	$2.42x10^{-5}$	$6.83x10^{-7}$	$1.12x10^{-6}$
	%	21%	4.2%	13%	20%	0.10%	38%	1.1%	1.8%
Radioactive waste disposed (low-level)	kg	$1.98x10^{-4}$	$1.59x10^{-4}$	$3.66x10^{-5}$	$7.09x10^{-4}$	$6.40x10^{-6}$	$9.83x10^{-5}$	$1.99x10^{-4}$	$2.91x10^{-5}$
	%	14%	11%	2.5%	49%	0.45%	6.8%	14%	2.0%
Components for re-use (CRU)	kg	0	0	0	0	0	0	0	0
Materials for recycling	kg	0	0	0	0	0	0	0	0.15
	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100%
Materials for energy recovery	kg	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Exported energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Recovered energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

Neg. = Negligible
INA = Indicator Not Assessed

Table 15. *Life Cycle Impact Assessment (LCIA) results for the Korlok product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. (United Kingdom)*

Impact category	Unit	A1 Raw material extraction and processing	A2 Transport to manufacturer	A3 Manufacturing	A4 Transport	A5 Construction - installation	B1 Use & Maintenance	C2 Transport	C4 Disposal
CML-IA									
Global Warming Potential (GWP 100)	kg CO_2 eq	22.3	1.94	6.63	7.35	0.358	7.04	1.95	12.0
	%	37%	3.3%	11%	12%	0.60%	12%	3.3%	20%
Acidification Potential (AP)	kg SO_2 eq	$7.08x10^{-2}$	$1.08x10^{-2}$	$3.75x10^{-2}$	$9.79x10^{-2}$	$3.68x10^{-4}$	$2.14x10^{-2}$	$9.31x10^{-3}$	$3.28x10^{-3}$
	%	28%	4.3%	15%	39%	0.15%	8.5%	3.7%	1.3%
Eutrophication Potential (EP)	kg $(PO_4)^{3-}$ eq	$1.43x10^{-2}$	$2.40x10^{-3}$	$7.05x10^{-3}$	$1.17x10^{-2}$	$1.33x10^{-3}$	$1.70x10^{-2}$	$1.96x10^{-3}$	$5.10x10^{-2}$
	%	13%	2.3%	6.6%	11%	1.2%	16%	1.8%	48%
Ozone Depletion Potential (ODP)	kg CFC-11 eq.	$4.35x10^{-7}$	$2.83x10^{-7}$	$8.10x10^{-8}$	$1.25x10^{-6}$	$1.12x10^{-8}$	$3.10x10^{-7}$	$3.55x10^{-7}$	$6.02x10^{-8}$
	%	16%	10%	2.9%	45%	0.40%	11%	13%	2.2%
Photochemical Oxidant Creation Potential (POCP)	kg C_2H_4 eq	$4.04x10^{-3}$	$4.40x10^{-4}$	$1.71x10^{-3}$	$3.32x10^{-3}$	$7.59x10^{-5}$	$3.55x10^{-3}$	$3.68x10^{-4}$	$1.18x10^{-3}$
	%	28%	3.0%	12%	23%	0.52%	24%	2.5%	8.1%
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq	$1.53x10^{-5}$	$4.59x10^{-6}$	$1.82x10^{-6}$	$1.06x10^{-5}$	$5.10x10^{-8}$	$1.07x10^{-5}$	$1.30x10^{-6}$	$4.94x10^{-7}$
	%	34%	10%	4.1%	24%	0.11%	24%	2.9%	1.1%
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	528	27.6	59.8	111	0.978	31.5	29.6	6.16
	%	66%	3.5%	7.5%	14%	0.12%	4.0%	3.7%	0.78%
TRACI 2.1									
Global Warming Potential (GWP 100)	kg CO_2 eq	21.9	1.93	6.45	7.32	0.300	6.99	1.95	11.0
	%	38%	3.3%	11%	13%	0.52%	12%	3.4%	19%
Acidification Potential (AP)	kg SO_2 eq	$7.35x10^{-2}$	$1.22x10^{-2}$	$3.70x10^{-2}$	0.101	$4.51x10^{-4}$	$2.26x10^{-2}$	$1.13x10^{-2}$	$4.03x10^{-3}$
	%	28%	4.7%	14%	38%	0.17%	8.6%	4.3%	1.5%
Eutrophication Potential (EP)	kg N eq	$2.13x10^{-2}$	$3.01x10^{-3}$	$1.30x10^{-2}$	$1.10x10^{-2}$	$3.51x10^{-3}$	$3.50x10^{-2}$	$1.59x10^{-3}$	0.136
	%	9.5%	1.3%	5.8%	4.9%	1.6%	16%	0.71%	61%
Ozone Depletion Potential (ODP)	kg CFC-11 eq	$4.35x10^{-7}$	$2.83x10^{-7}$	$7.88x10^{-8}$	$1.25x10^{-6}$	$1.12x10^{-8}$	$3.10x10^{-7}$	$3.55x10^{-7}$	$6.02x10^{-8}$
	%	16%	10%	2.8%	45%	0.40%	11%	13%	2.2%
Smog Formation Potential (SFP)	kg O_3 eq	1.23	0.270	0.356	1.63	$1.13x10^{-2}$	0.238	0.310	$8.68x10^{-2}$
	%	30%	6.5%	8.6%	39%	0.27%	5.8%	7.5%	2.1%
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil})	MJ surplus	71.0	3.38	2.38	14.8	0.134	2.54	4.18	0.757
	%	72%	3.4%	2.4%	15%	0.14%	2.6%	4.2%	0.76%

Table 16. *Resource use, waste and outflows for the Korlok product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. (United Kingdom)*

Impact category	Unit	A1 Raw material extraction and processing	A2 Transport to manufacturer	A3 Manufacturing	A4 Transport	A5 Construction - installation	B1 Use & Maintenance	C2 Transport	C4 Disposal
Resource Use									
Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ	12.6	0.705	17.9	2.04	$1.18x10^{-2}$	44.0	0.127	0.266
	%	16%	0.91%	23%	2.6%	0.02%	57%	0.16%	0.34%
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0	0	0	0	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ.	INA	INA	INA	INA	INA	INA	INA	INA
Use of secondary materials	kg	0	0	1.1	0	0	0	0	0
	%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	0.00%	0.00%
Use of renewable secondary fuels	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Use of non-renewable secondary fuels	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Use of net fresh water	m^3	4.03	$3.53x10^{-2}$	0.174	0.115	$1.17x10^{-3}$	1.14	$1.02x10^{-2}$	$3.05x10^{-2}$
	%	73%	0.64%	3.1%	2.1%	0.02%	21%	0.18%	0.55%
Waste Flows									
Non-hazardous waste disposed	kg	$4.72x10^{-5}$	$2.27x10^{-5}$	$5.31x10^{-5}$	$6.27x10^{-5}$	$5.05x10^{-7}$	$4.17x10^{-5}$	$9.61x10^{-6}$	$1.45x10^{-5}$
	%	19%	9.0%	21%	25%	0.20%	17%	3.8%	5.7%
Hazardous waste disposed	kg	1.48	0.921	1.95	2.40	0.471	0.503	0.120	14.1
	%	6.7%	4.2%	8.9%	11%	2.1%	2.3%	0.55%	64%
Radioactive waste disposed (high-level)	kg	$1.31x10^{-5}$	$2.64x10^{-6}$	$8.48x10^{-6}$	$1.27x10^{-5}$	$5.06x10^{-8}$	$2.21x10^{-5}$	$6.83x10^{-7}$	$1.10x10^{-6}$
	%	22%	4.3%	14%	21%	0.08%	36%	1.1%	1.8%
Radioactive waste disposed (low-level)	kg	$1.98x10^{-4}$	$1.59x10^{-4}$	$3.66x10^{-5}$	$7.10x10^{-4}$	$6.10x10^{-6}$	$1.60x10^{-4}$	$1.99x10^{-4}$	$2.85x10^{-5}$
	%	13%	11%	2.4%	47%	0.41%	11%	13%	1.9%
Components for re-use (CRU)	kg	0	0	0	0	0	0	0	0
Materials for recycling	kg	0	0	0	0	0	0	0	0.18
	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100%
Materials for energy recovery	kg	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Exported energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

Neg. = Negligible
INA = Indicator Not Assessed

Table 17. *Life Cycle Impact Assessment (LCIA) results for the Korlok product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. (Australia)*

Impact category	Unit	A1 Raw material extraction and processing	A2 Transport to manufacturer	A3 Manufacturing	A4 Transport	A5 Construction - installation	B1 Use & Maintenance	C2 Transport	C4 Disposal
CML-IA									
Global Warming Potential (GWP 100)	kg CO_2 eq	22.3	1.94	6.63	5.54	0.437	7.69	1.95	10.9
	%	39%	3.4%	12%	9.7%	0.76%	13%	3.4%	19%
Acidification Potential (AP)	kg SO_2 eq	$7.08x10^{-2}$	$1.08x10^{-2}$	$3.75x10^{-2}$	$6.02x10^{-2}$	$3.54x10^{-4}$	$2.24x10^{-2}$	$9.31x10^{-3}$	$3.05x10^{-3}$
	%	33%	5.0%	17%	28%	0.17%	10%	4.3%	1.4%
Eutrophication Potential (EP)	kg $(PO_4)^{3-}$ eq	$1.43x10^{-2}$	$2.40x10^{-3}$	$7.05x10^{-3}$	$7.82x10^{-3}$	$1.80x10^{-3}$	$2.55x10^{-2}$	$1.96x10^{-3}$	$5.47x10^{-2}$
	%	12%	2.1%	6.1%	6.8%	1.6%	22%	1.7%	47%
Ozone Depletion Potential (ODP)	kg CFC-11 eq.	$4.35x10^{-7}$	$2.83x10^{-7}$	$8.10x10^{-8}$	$9.65x10^{-7}$	$1.14x10^{-8}$	$2.71x10^{-7}$	$3.55x10^{-7}$	$5.91x10^{-8}$
	%	18%	12%	3.3%	39%	0.46%	11%	14%	2.4%
Photochemical Oxidant Creation Potential (POCP)	kg C_2H_4 eq	$4.04x10^{-3}$	$4.40x10^{-4}$	$1.71x10^{-3}$	$2.09x10^{-3}$	$9.34x10^{-5}$	$3.56x10^{-3}$	$3.68x10^{-4}$	$1.27x10^{-3}$
	%	30%	3.2%	13%	15%	0.69%	26%	2.7%	9.3%
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq	$1.53x10^{-5}$	$4.59x10^{-6}$	$1.82x10^{-6}$	$1.02x10^{-5}$	$4.84x10^{-8}$	$1.07x10^{-5}$	$1.30x10^{-6}$	$4.57x10^{-7}$
	%	34%	10%	4.1%	23%	0.11%	24%	2.9%	1.0%
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	528	27.6	59.8	85.0	0.997	38.1	29.6	6.10
	%	68%	3.6%	7.7%	11%	0.13%	4.9%	3.8%	0.79%
TRACI 2.1									
Global Warming Potential (GWP 100)	kg CO_2 eq	21.9	1.93	6.45	5.52	0.361	7.65	1.95	9.81
	%	39%	3.5%	12%	9.9%	0.65%	14%	3.5%	18%
Acidification Potential (AP)	kg SO_2 eq	$7.35x10^{-2}$	$1.22x10^{-2}$	$3.70x10^{-2}$	$6.26x10^{-2}$	$4.33x10^{-4}$	$2.37x10^{-2}$	$1.13x10^{-2}$	$3.73x10^{-3}$
	%	33%	5.4%	16%	28%	0.19%	11%	5.0%	1.7%
Eutrophication Potential (EP)	kg N eq	$2.13x10^{-2}$	$3.01x10^{-3}$	$1.30x10^{-2}$	$7.75x10^{-3}$	$4.81x10^{-3}$	$5.49x10^{-2}$	$1.59x10^{-3}$	0.146
	%	8.4%	1.2%	5.1%	3.1%	1.9%	22%	0.63%	58%
Ozone Depletion Potential (ODP)	kg CFC-11 eq	$4.35x10^{-7}$	$2.83x10^{-7}$	$7.88x10^{-8}$	$9.64x10^{-7}$	$1.14x10^{-8}$	$2.70x10^{-7}$	$3.55x10^{-7}$	$5.91x10^{-8}$
	%	18%	12%	3.2%	39%	0.46%	11%	14%	2.4%
Smog Formation Potential (SFP)	kg O_3 eq	1.23	0.270	0.356	1.06	$1.05x10^{-2}$	0.267	0.310	$7.70x10^{-2}$
	%	34%	7.5%	9.9%	30%	0.29%	7.4%	8.6%	2.1%
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil})	MJ surplus	71.0	3.38	2.38	11.4	0.137	2.63	4.18	0.749
	%	74%	3.5%	2.5%	12%	0.14%	2.7%	4.4%	0.78%

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Table 18. *Resource use, waste and outflows for the Korlok product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. (Australia)*

Impact category	Unit	A1 Raw material extraction and processing	A2 Transport to manufacturer	A3 Manufacturing	A4 Transport	A5 Construction - installation	B1 Use & Maintenance	C2 Transport	C4 Disposal
Resource Use									
Use of renewable primary energy excluding the renewable primary energy resources used as raw materials	MJ	12.6	0.705	17.9	1.42	$1.28x10^{-2}$	43.6	0.127	0.266
	%	16%	0.92%	23%	1.9%	0.02%	57%	0.17%	0.35%
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0	0	0	0	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ.	INA	INA	INA	INA	INA	INA	INA	INA
Use of secondary materials	kg	0	0	1.1	0	0	0	0	0
	%	0.00%	0.00%	100%	0.00%	0.00%	0.00%	0.00%	0.00%
Use of renewable secondary fuels	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Use of non-renewable secondary fuels	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Use of net fresh water	m^3	4.03	$3.53x10^{-2}$	0.174	$8.03x10^{-2}$	$9.83x10^{-4}$	1.15	$1.02x10^{-2}$	$2.70x10^{-2}$
	%	73%	0.64%	3.2%	1.5%	0.02%	21%	0.19%	0.49%
Waste Flows									
Non-hazardous waste disposed	kg	$4.72x10^{-5}$	$2.27x10^{-5}$	$5.31x10^{-5}$	$4.81x10^{-5}$	$4.81x10^{-7}$	$1.07x10^{-4}$	$9.61x10^{-6}$	$1.40x10^{-5}$
	%	16%	7.5%	18%	16%	0.16%	35%	3.2%	4.6%
Hazardous waste disposed	kg	1.48	0.921	1.95	2.38	0.651	0.492	0.120	15.2
	%	6.4%	4.0%	8.4%	10%	2.8%	2.1%	0.52%	66%
Radioactive waste disposed (high-level)	kg	$1.31x10^{-5}$	$2.64x10^{-6}$	$8.48x10^{-6}$	$8.46x10^{-6}$	$5.45x10^{-8}$	$7.03x10^{-6}$	$6.83x10^{-7}$	$1.12x10^{-6}$
	%	32%	6.3%	20%	20%	0.13%	17%	1.6%	2.7%
Radioactive waste disposed (low-level)	kg	$1.98x10^{-4}$	$1.59x10^{-4}$	$3.66x10^{-5}$	$5.46x10^{-4}$	$6.31x10^{-6}$	$6.54x10^{-5}$	$1.99x10^{-4}$	$2.91x10^{-5}$
	%	16%	13%	3.0%	44%	0.51%	5.3%	16%	2.4%
Components for re-use (CRU)	kg	0	0	0	0	0	0	0	0
Materials for recycling	kg	0	0	0	0	0	0	0	0.21
	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100%
Materials for energy recovery	kg	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Exported energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Recovered energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

Neg. = Negligible
INA = Indicator Not Assessed

6. LCA: Interpretation

Depending on the impact category, the contributions to indicator results for the product system over the 75-yr ESL are dominated by the raw material and extraction phase (*A1*) followed by product distribution (*A4*), product manufacturing (*A3*) and product disposal (*C1-C4*).

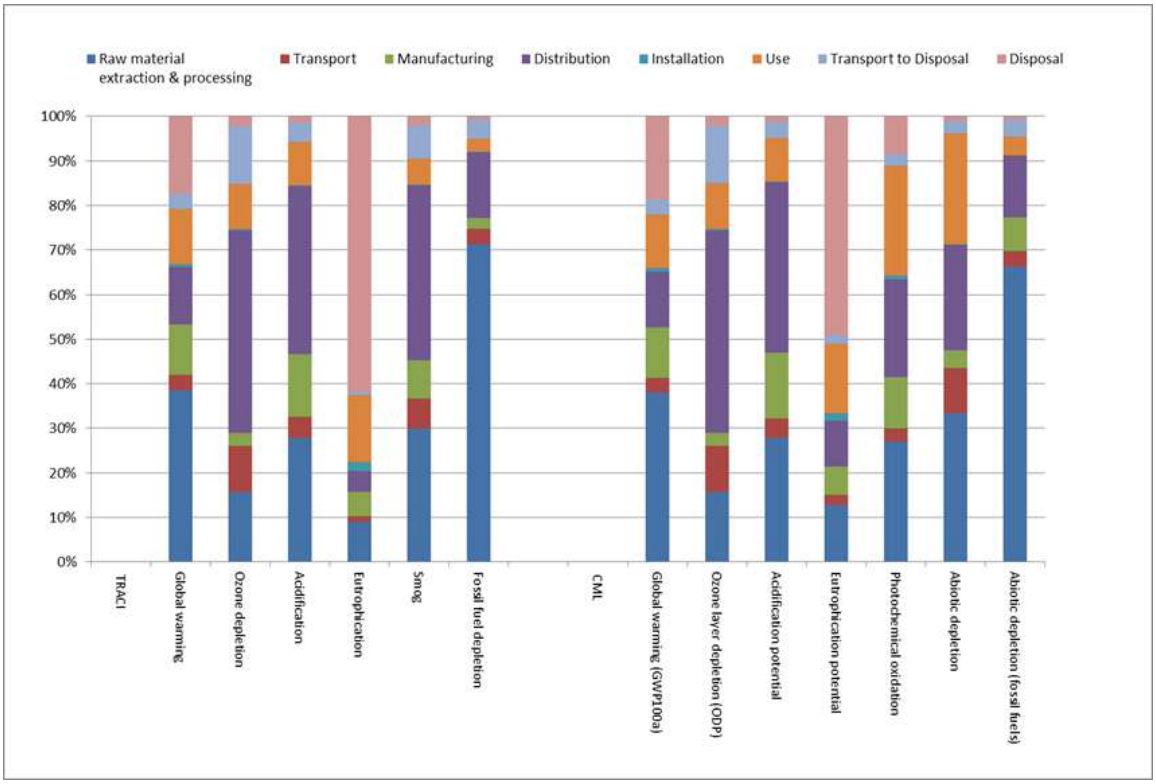

Figure 2. *Contribution analysis for the Korlok product system for the North American consumer market.*

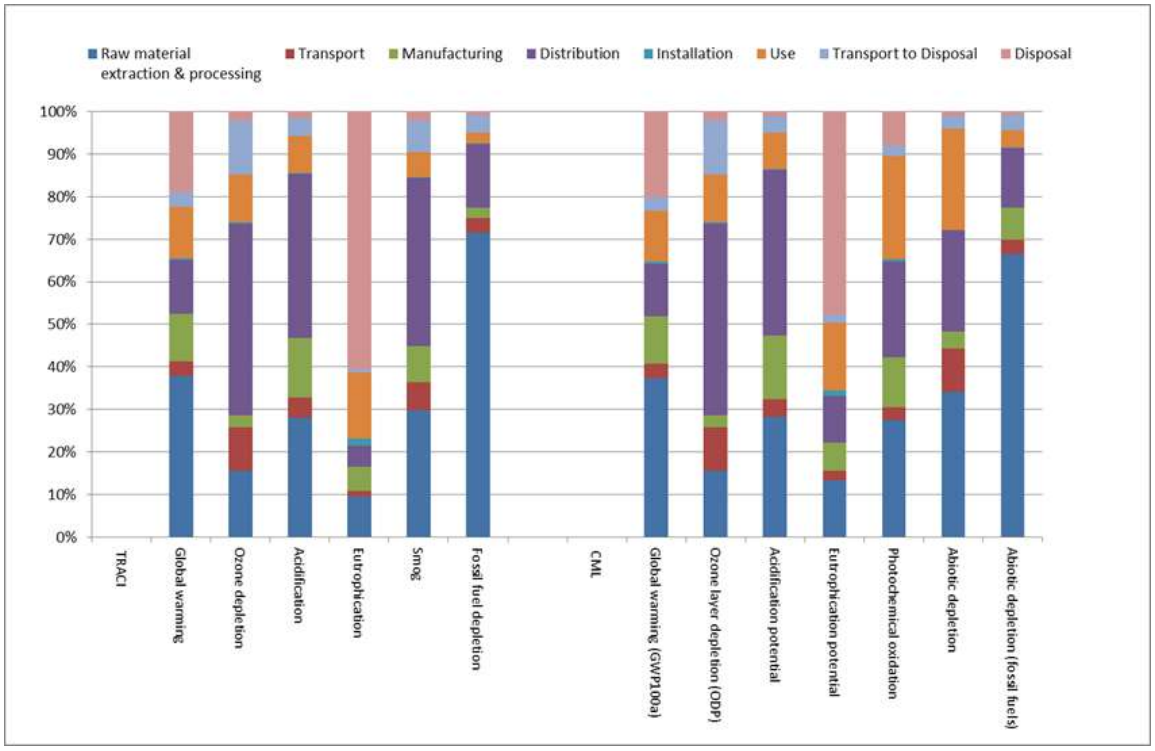

Figure 3. *Contribution analysis for the Korlok product system for the United Kingdom consumer market.*

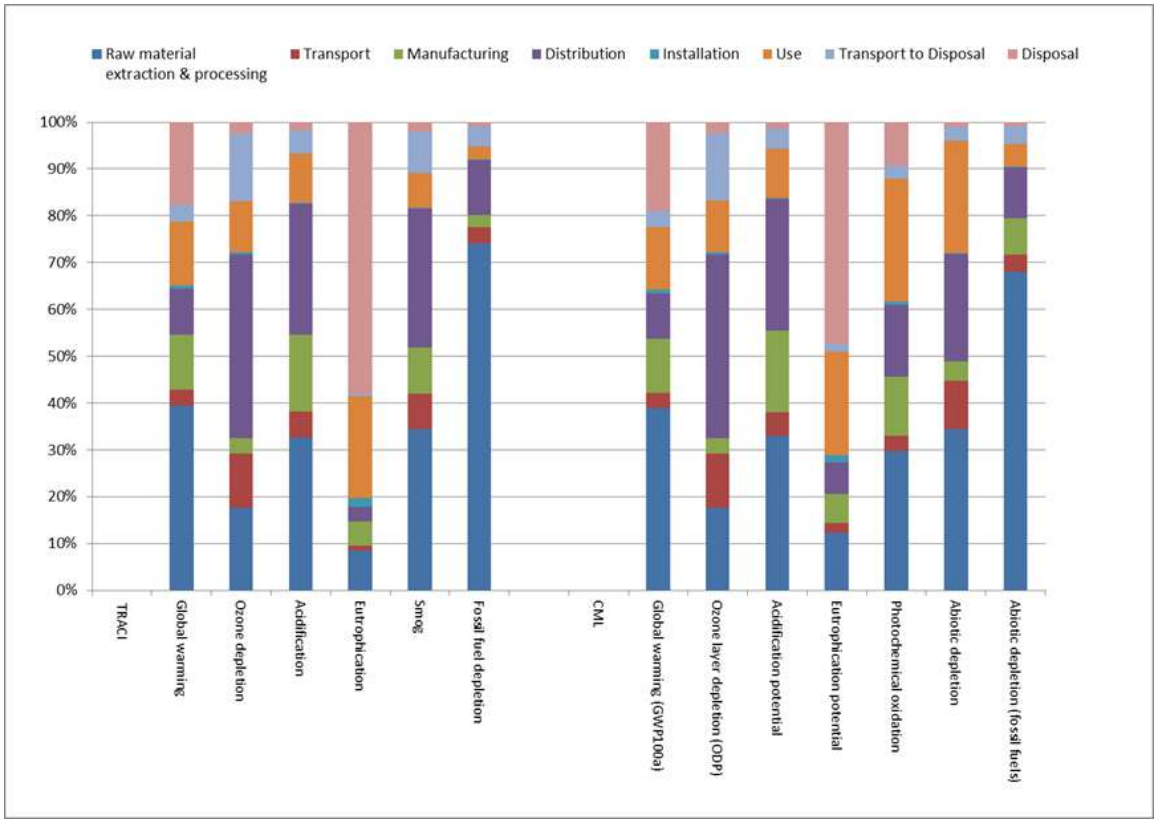

Figure 4. *Contribution analysis for the Korlok product system for the Australian consumer market.*

7. Additional Environmental Information

7.1 ENVIRONMENT AND HEALTH DURING MANUFACTURING

The Karndean manufacturing facility is certified to ISO 14001 – Environmental management systems.

7.2 ENVIRONMENT AND HEALTH DURING INSTALLATION

The Korlok flooring products meet the requirements of the following:

- Indoor Air Comfort Gold (VOC certification)
- CDPH/EHLB Standard Method v1.2-2017 (California Section 01350)

7.3 EXTRAORDINARY EFFECTS

Fire

The Korlok products meet the following fire classification and performance standards:

- EN 13501-1:2002: Fire classification of construction products and building elements. Classification using test data from reaction to fire tests. Korlok achieves a reaction to fire classification of B_{fl}-s1
- ASTM E648: Standard Test Method for Critical Radiant Flux of Floor-Covering Systems using a Radiant Heat Energy Source (also referenced as NFPA 253 and FTM Standard 372). Korlok achieves Class 1
- AS ISO 9239.1:2003: Reaction to fire tests for floor-coverings. Determination of the burning behavior using a radiant heat source.

7.4 ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS

The Korlok products are REACH compliant. Our accreditations and certifications include FloorScore, Indoor Air Comfort Gold.

For more information on Karndean Designflooring's certifications and environmental initiatives please view our Global Environmental Statement www.karndean.com/eco.

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For more information, contact:

Karndean Designflooring
Crab Apple Way, Vale Park, Evesham
Worcestershire, WR11 1GP, United Kingdom
01386 820 200 | commercial@karndean.co.uk | www.karndean.com

Karndean Designflooring USA
1100 Pontiac Court, Export, PA 15632
888 266 4343 | info@karndean.com | www.karndean.com

Karndean Designflooring Australia
835 Stud Road, Knoxfield, VIC 3180
1800 331 170 | customerservice@karndean.com.au | www.karndean.com

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.510.452.8000 | fax +1.510.452.8001

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