

**Declaration Owner**

NOX Corporation
67 Hwanggeumtteul-ro, Bongsan-myeon,
Yesan-gun, Chungcheongnam-do, Korea
www.noxglobal.com | 82-2-520-7690

Product

Luxury Olefin Tile (LOT) EVERECO+

Functional Unit

The functional unit is one square meter of floor covering provided and maintained for a period of 60 years.

EPD Number and Period of Validity

SCS-EPD-05541
EPD Valid May 29, 2019 through May 28, 2024

Product Category Rule

Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International. Version 2. 2014.

Program Operator

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



Table of Contents

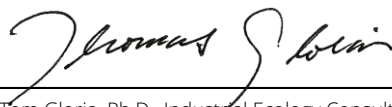
PRODUCT SCOPE.....	cover
ABOUT NOX CORPORATION.....	2
PRODUCT DESCRIPTION.....	2
PRODUCT APPLICATION.....	2
PRODUCT PERFORMANCE.....	3
MATERIAL CONTENT.....	4
PRODUCTION OF MAIN MATERIALS.....	4
PRODUCT CHARACTERISTICS.....	4
LIFE CYCLE ASSESSMENT.....	5
FUNCTIONAL UNIT.....	5
PRODUCT LIFE CYCLE FLOW DIAGRAM.....	5
LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION.....	7
LIFE CYCLE INVENTORY.....	8
LIFE CYCLE IMPACT ASSESSMENT.....	9
SUPPORTING TECHNICAL INFORMATION.....	12
REFERENCES.....	15

Disclaimers: This EPD conforms to ISO 14025, 14040, ISO 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.

PCR review, was conducted by	Jack Geibig, EcoForm. jgeibig@ecoform.com
Approved Date: May 29, 2019 – End Date: May 28, 2024	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930: 2007.	☐ internal ☒ external
Third party verifier	 Tom Gloria, Ph.D., Industrial Ecology Consultants

ABOUT NOX CORPORATION

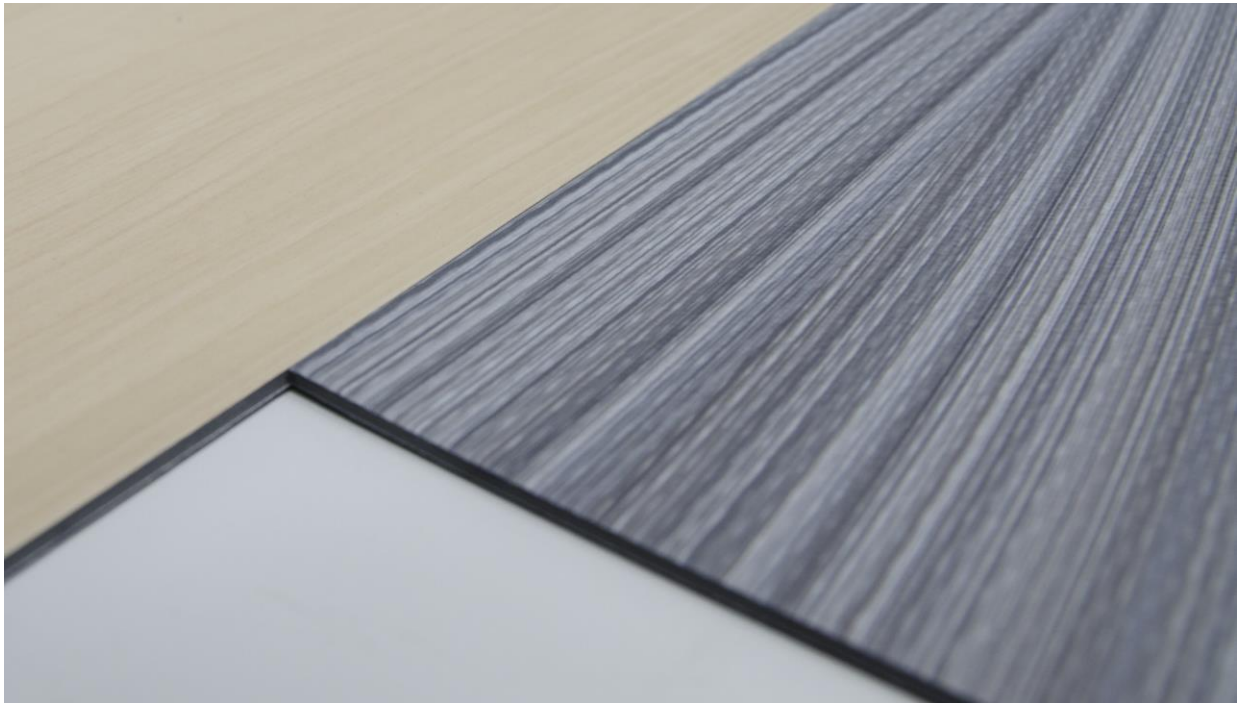
Rooted in a chemical engineering company established in 1966, NOX Corporation has built its core expertise in producing and processing various resin compounds for applications ranging from consumer to industrial goods. With this heritage, NOX Corporation was founded in 1994 as a family-owned company, focusing on LVT flooring innovation, design and manufacturing for global customers. As one of the largest LVT manufacturers globally, our capacity is now over 50 million square meters annually. We operate with the commitment of investment in our customer's needs - a promise to support stable and significant growth for customers.

PRODUCT DESCRIPTION

The resilient floor covering product in this EPD is manufactured in an ISO 9001 and ISO 14001 facility in Yesan-gun, Chungcheongnam-do, Korea. The manufacturer warrants for a period of 15 years from the date of purchase, which is used as the reference service life in this EPD. The 3.0 mm NOX EVERECO+ product line is sold with either a 0.30 mm or a 0.50 mm wear layer thickness. For this EPD, a 0.50 mm wear layer is used for the representative product.

PRODUCT APPLICATION

The resilient flooring product in this EPD is used in various commercial and residential applications.



PRODUCT PERFORMANCE

Table 1. Product performance test results for NOX LOT EVERECO+ flooring.

Test Item	Test Method	Requirements	Results
Overall thickness	ASTM F386	Nominal ± 0.005 in. (0.127mm)	Meets
Wear-layer thickness	ASTM F410	20mil (0.51 mm)	Meets
Dimension	ASTM F2055	± 0.016 in. per linear foot (± 1.3 mm per linear meter)	Meets
Squareness	ASTM F2055	Maximum 0.010 in. (0.25mm)	Meets
Indentation At a temperature of 77 degrees F. (1 min)	F1914	0.007 to 0.012 in. (0.178 to 0.30 mm)	Meets
Residual indentation	ASTM F1914	Average less than 8%	Meets
Dimensional stability	ASTM F2199	0.024 in /ln-ft maximum (2.0 mm /ln-m maximum)	Meets
Curling after exposure to heat	EN ISO 23999	± 2 mm (± 0.079 in)	Meets
Chemical resistance	ASTM F925	No more than a slight change in surface dulling, surface attack, or staining	Meets
Resistance to light	ASTM F1515	$\Delta E < 8$ avg. MAX	Meets
Resistance to heat	ASTM F1514	$\Delta E < 8$ avg. MAX	Meets
Fire resistance – CRF	ASTM E648	Class 1 (0.45 w/Cm ² or more)	Meets
Fire resistance (Smoke density)	ASTM E662	450 or less	Meets
Deflection (MD and AMD)	ASTM F1304	1 in (25.4mm) min	Meets
Impact	ASTM F1265	No cracks beyond limit after 4 drops	Meets
Static load limit	ASTM F970	0.005 in or less (0.127 mm or less)	Meets
Indoor air quality	CDPH v1.1 (2017)	Low VOC	Floorscore® Certified

MATERIAL CONTENT

Table 2. *Origin and availability of material content for LOT EVERECO+ (3.0 mm)*

Product Materials							
Component	Materials	Amount (kg/m ²)	Percent of Total (%)	Availability			Origin of Raw Materials
				Renewable	Non-renewable	Recycled (% pre-/post-consumer)	
Polyolefin Mid-Bottom Layer	Confidential	3.21	65.2%	-	Fossil, limited; Mineral, abundant	20%/0%	Global
Polypropylene Wear Layer	Confidential	0.730	14.8%	-	Fossil, limited	0%/0%	Global
Polypropylene Balance Layer	Confidential	0.730	14.8%	-	Fossil, limited	0%/0%	Global
Polypropylene Print Film	Confidential	0.120	2.44%	-	Fossil, limited	0%/0%	Global
Fiberglass Layer	Confidential	0.120	2.44%	-	Mineral, abundant; Fossil, limited	0%/0%	Global
Polyurethane Coating Layer	Confidential	1.50x10 ⁻²	0.305%	-	Fossil, limited; Mineral, abundant	0%/0%	Global
TOTAL	-	4.93	100%	-	-	13%/0%	-

In conformance with the PCR, product materials were reviewed for the presence of any hazardous chemicals. A review of Material Data Safety Sheets (MSDS) provided by the manufacturer reveals the presence of the following regulated chemicals in the product (this does not indicate that the threshold for reportable quantities is exceeded):

- Fiber Glass Continuous Filament (CAS# 65997-17-3)
- Silica (CAS# 7631-86-9)

PRODUCTION OF MAIN MATERIALS

Fiberglass: A composite material made of a reinforced polymer matrix using glass fibers.

Polypropylene: A linear hydrocarbon polymer and a thermoplastic polymer. It is produced via chain-growth polymerization from the monomer propylene.

PRODUCT CHARACTERISTICS

Table 3. *Product characteristics for LOT EVERECO+ (3.0 mm).*

Characteristic			Nominal Values	Unit	Maximum Value	Minimum Value
Product thickness			3.0	mm	3.0	3.0
			(0.12)	(in)	(0.12)	(0.12)
Wear layer thickness			0.50	mm	(0.50)	(0.30)
			(0.020)	(in)	(0.020)	(0.012)
Product Weight			4.93	kg/m ²	5.05	4.93
			(16.1)	(oz/ft ²)	(16.6)	(16.1)
VOC emissions test method			FloorScore®		-	
Sustainable Certifications			FloorScore®		-	
Product form	Tiles	Width	177.8	mm	914.4	152.4
		Length	1,219.2	mm	1,219.4	457.2

LIFE CYCLE ASSESSMENT

A cradle to grave life cycle assessment (LCA) was completed for this product group in accordance with ISO 14040, ISO 14044, ISO 21930, and Product Category Rule for Environmental Product Declarations for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood (Version 2).



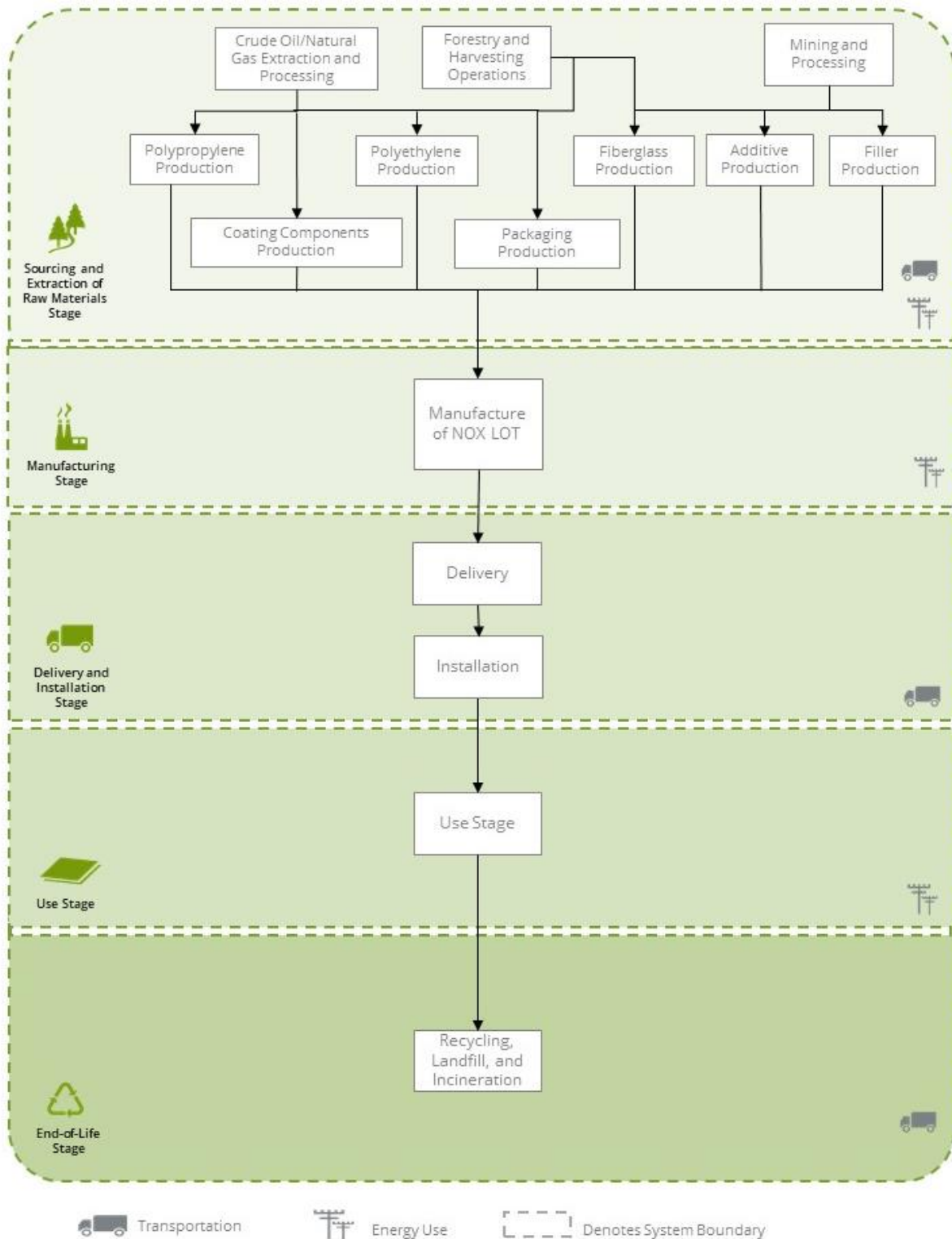
FUNCTIONAL UNIT

The functional unit is, according to the PCR, the total impact for the expected life of the building (60 years). But the service life is dependent on the product lifetime, which is 15 years in this case. The PCR consequently requires separate reporting of LCA results A) for 1 m² of floor covering - extraction/processing, manufacturing, delivery and installation and end of life, B) the average 1- year use stage, and C) for the 60-year life of the building as combined using A) and B), calculated from the reference service life (RSL) of the product.

PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of NOX LOT EVERECO+. This includes resource extraction and processing, product manufacture, use and maintenance, and end-of-life.

Process Life Cycle Flow Diagram for NOX LOT EVERECO+



LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION

Sourcing/Extraction Stage (raw material acquisition)

This stage includes extraction and processing of raw materials used for packaging and the manufacturing of resilient floor covering, including delivery of these material components to the production site.

Manufacturing Stage

This stage includes all the relevant manufacturing processes and flows, including the impacts from energy use, emissions, and wastes at the facility. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are excluded.

Delivery and Installation Stage

Delivery

This stage includes the delivery of the flooring product to the point of installation. Modeling used in the life cycle assessment assumed an estimated distribution distance to point of sale of 11,500 kilometers (7,145 miles) via ship and 910 kilometers (566 miles) via diesel truck, representing transport from the manufacturing facility in to various locations across the United States.

Installation

The manufacturer provides recommended installation guidance on the web:
<http://www.noxglobal.com/eng/information/info.asp>

Waste

Waste generated during product installation can be disposed of in a landfill, incinerated, or recycled.

Packaging

Table 4. *Origin and availability of material content for packaging of NOX LOT EVERECO+.*

Packaging Materials							
Component	Materials	Amount (kg/m ²)	Percent of Total (%)	Availability			Origin of Raw Materials
				Renewable	Non-renewable	Recycled (% pre-/post-consumer)	
Boards and Pallets	Wood	1.02x10 ⁻³	50.0%	Biogenic		0%/0%	Global
Cardboard Box	Corrugated Board	1.00x10 ⁻³	48.8%	Biogenic	Fossil, limited	0%/0%	Global
Straps	Polyester	1.75x10 ⁻⁵	0.855%		Fossil, limited	0%/0%	Global
Wrapping	Polyethylene	6.86x10 ⁻⁶	0.335%		Fossil, limited	0%/0%	Global
TOTAL	-	2.05x10⁻³	100%	-	-	0%/0%	-

Use Stage

Cleaning and maintenance

Table 5. *Cleaning and maintenance for NOX LOT EVERECO+.*

Cleaning Process	Cleaning Frequency / Traffic Level			Method
	Light	Moderate	Heavy	
Daily Maintenance*	208 days/year	156 days/year	0 days/year	Sweep and mop (water only)
Routine Cleaning	52 days/year	104 days/year	260 days/year	Sweep and mop (3 oz neutral cleaner/gal water or 23 mL neutral cleaner/ L water)

*Based on working days per year minus the days for routine cleaning.

End-of-Life Stage

Recycling, reuse, or repurpose

Data for the estimation of recycling rates for the product and packaging are based on data prepared for the US Environmental Protection Agency Municipal Solid Waste Report. These data provide 2014 statistics on US disposal, including recycling rates.

Table 6. *Recycling rates based on 2014 US EPA Municipal Solid Waste statistics.*

Material	Durable Goods	Packaging
Paper and paperboard	N/A	75.4%
Plastics	6.6%	14.8%
Wood	N/A	26.4%

Disposal

For disposal of product materials, it is assumed that 20% are incinerated and 80% go to a landfill, based on the US EPA data. Transportation of waste materials at end of life assumes a 32 kilometer (20 mile) average distance to disposal, consistent with assumptions used in the US EPA WARM model.

LIFE CYCLE INVENTORY

In accordance with ISO 21930:2007, the following aggregated inventory flows are included in the LCA, in addition to the LCIA and inventory flow requirements specified by the PCR:

- Use of renewable material resources
- Use of non-renewable material resources
- Consumption of freshwater
- Hazardous waste
- Non-hazardous waste

All results are calculated using the openLCA v1.7.4 model using primary and secondary inventory data. Classification for the use of material resources is based on a review of materials in the foreground system.

Table 7. Aggregated inventory flows, shown in kg per 1 m² of NOX LOT EVERECO+ (3.0 mm) maintained for 60 years.

Parameter	Units	Sourcing and Extraction	Manufacturing	Delivery and Installation	Use	End of Life	Total
Total Primary Energy Consumption							
Non-renewable energy resources	MJ	700	1.4	110	110	17	930
Renewable primary energy	MJ	11	1.0x10 ⁻²	3.0	29	0.35	44
Material Resources Consumption							
Non-renewable material resources	kg	10	0.0	Neg	2.7	Neg	13
Renewable material resources	kg	0.0	0.0	Neg	Neg	Neg	0.0
Freshwater	m ³	0.75	6.6x10 ⁻³	0.22	3.0	2.4x10 ⁻²	4.0
Waste Generated							
Hazardous waste	kg	8.7x10 ⁻⁵	1.0x10 ⁻⁵	8.4x10 ⁻⁵	1.8x10 ⁻⁴	2.3x10 ⁻⁵	3.9x10 ⁻⁴
Non-hazardous waste	kg	1.3	1.3x10 ⁻²	2.5	1.0	15	20

Neg = Negligible

LIFE CYCLE IMPACT ASSESSMENT

The impact assessment for the EPD is conducted in accordance with requirements of the PCR. Impact category indicators are estimated using the CML-IA (Table 8 through Table 10) and TRACI 2.1 (Table 11 through Table 13) characterization methods. Aggregated inventory flows for energy use are also calculated. The LCIA and inventory flow results are calculated using openLCA v1.7.4 software and declared in this EPD in the following ways:

- **Table A:** The potential impacts for 1 m² of floor covering for each of the following life cycle stages: sourcing/extraction, manufacturing, delivery and installation, and end of life. The impacts are not normalized to the 60-year reference service life of the building.
- **Table B:** The impacts for the use stage for 1 m² of floor covering for an average one-year use.
- **Table C:** The total impacts of all life cycle stages based on the estimated replacement schedule for 1 m² of floor covering over a 60-year reference service life of a building.

Table 8. Table A: Cradle to install and end of life LCIA results for 1 m² of NOX LOT EVERECO+ (3.0 mm). Results are calculated using CML-IA.

Impact Category	Units	Sourcing and Extraction	Manufacturing	Delivery and Installation	End of Life	Total
Abiotic Depletion Potential (Elements)	kg Sb eq	2.7x10 ⁻⁵ 83%	9.5x10 ⁻⁹ 0.030%	5.1x10 ⁻⁶ 16%	2.5x10 ⁻⁷ 0.79%	3.2x10 ⁻⁵ 100%
Abiotic Depletion Potential (Fossil Fuels)	MJ	220 86%	0.28 0.11%	30 12%	4.4 1.8%	250 100%
Global Warming Potential	kg CO ₂ eq	7.2 60%	2.3x10 ⁻² 0.19%	1.9 16%	3.0 25%	12 100%
Ozone Depletion Potential	kg CFC-11 eq	3.1x10 ⁻⁷ 48%	2.4x10 ⁻⁹ 0.38%	2.8x10 ⁻⁷ 43%	5.1x10 ⁻⁸ 7.9%	6.5x10 ⁻⁷ 100%
Photochemical Oxidant Formation Potential	kg C ₂ H ₄ eq	1.7x10 ⁻³ 55%	2.9x10 ⁻⁶ 0.10%	8.2x10 ⁻⁴ 27%	5.4x10 ⁻⁴ 18%	3.0x10 ⁻³ 100%
Acidification Potential	kg SO ₂ eq	2.6x10 ⁻² 56%	7.9x10 ⁻⁵ 0.17%	1.9x10 ⁻² 40%	1.7x10 ⁻³ 3.7%	4.7x10 ⁻² 100%
Eutrophication Potential	kg PO ₄ ³⁻ eq	3.1x10 ⁻³ 19.7%	5.2x10 ⁻⁵ 0.33%	2.8x10 ⁻³ 18%	9.9x10 ⁻³ 62%	1.6x10 ⁻² 100%
Primary Energy, Non-Renewable	MJ	180 85%	0.34 0.16%	27 13%	4.1 2.0%	210 100%
Primary Energy, Renewable	MJ	2.8 77%	2.6x10 ⁻³ 0.070%	0.75 21%	8.6x10 ⁻² 2.4%	3.6 100%

Table 9. Table C: Cradle to grave impacts over 60-year building service life for 1 m² of NOX LOT EVERECO+ (3.0 mm). Results are calculated using CML-IA.

Impact Category	Units	Sourcing and Extraction	Manufacturing	Delivery and Installation	Use	End of Life	Total
Abiotic Depletion Potential (Elements)	kg Sb eq	1.1x10 ⁻⁴ 61%	3.8x10 ⁻⁸ 0.020%	2.0x10 ⁻⁵ 12%	4.6x10 ⁻⁵ 26%	1.0x10 ⁻⁶ 0.59%	1.7x10 ⁻⁴ 100%
Abiotic Depletion Potential (Fossil Fuels)	MJ	810 75%	1.1 0.11%	120 11%	130 12%	18 1.6%	1,100 100%
Global Warming Potential	kg CO ₂ eq	27 48%	9.4x10 ⁻² 0.17%	7.6 14%	9.4 17%	12 22%	56 100%
Ozone Depletion Potential	kg CFC-11 eq	1.2x10 ⁻⁶ 30%	9.8x10 ⁻⁹ 0.23%	1.1x10 ⁻⁶ 27%	1.6x10 ⁻⁶ 38%	2.0x10 ⁻⁷ 4.89%	4.2x10 ⁻⁶ 100%
Photochemical Oxidant Formation Potential	kg C ₂ H ₄ eq	5.9x10 ⁻³ 42%	1.2x10 ⁻⁵ 0.082%	3.3x10 ⁻³ 23%	2.7x10 ⁻³ 19%	2.2x10 ⁻³ 15%	1.4x10 ⁻² 100%
Acidification Potential	kg SO ₂ eq	0.10 42%	3.2x10 ⁻⁴ 0.14%	7.5x10 ⁻² 32%	5.3x10 ⁻² 23%	6.9x10 ⁻³ 3.0%	0.23 100%
Eutrophication Potential	kg PO ₄ ³⁻ eq	4.1x10 ⁻³ 5.7%	2.1x10 ⁻⁴ 0.29%	1.1x10 ⁻² 16%	1.7x10 ⁻² 23%	4.0x10 ⁻² 55%	7.2x10 ⁻² 100%
Primary Energy, Non-Renewable	MJ	700 75%	1.4 0.14%	110 12%	110 11%	17 1.8%	930 100%
Primary Energy, Renewable	MJ	11 26%	1.0x10 ⁻² 0.023%	3.0 6.9%	29 67%	0.35 0.79%	44 100%

Table 10. Table B: Average 1-year use stage impacts for 1 m² of NOX LOT EVERECO+. Results are calculated using CML-IA.

Impact Category	Units	Average 1-year Use and Maintenance Impacts
Abiotic Depletion Potential (Elements)	kg Sb eq	7.6x10 ⁻⁷
Abiotic Depletion Potential (Fossil Fuels)	MJ	2.1
Global Warming Potential	kg CO ₂ eq	0.16
Ozone Depletion Potential	kg CFC-11 eq	2.7x10 ⁻⁸
Photochemical Oxidant Formation Potential	kg C ₂ H ₄ eq	4.6x10 ⁻⁵
Acidification Potential	kg SO ₂ eq	8.8x10 ⁻⁴
Eutrophication Potential	kg PO ₄ ³⁻ eq	2.8x10 ⁻⁴
Primary Energy, Non-Renewable	MJ	1.8
Primary Energy, Renewable	MJ	0.49

Table 11. Cradle to install and end of life LCIA results for 1 m² of NOX LOT EVERECO+ (3.0 mm). Results are calculated using TRACI 2.1.

Impact Category	Units	NOX LOT EVERECO+ (3.0 mm)
Ozone depletion	kg CFC-11 eq	8.6x10 ⁻⁷
Global warming	kg CO ₂ eq	11
Smog	kg O ₃ eq	0.72
Acidification	kg SO ₂ eq	4.8x10 ⁻²
Eutrophication	kg N eq	3.8x10 ⁻²
Fossil fuel depletion	MJ surplus	37

Table 12. Cradle to grave impacts over 60-year building service life for 1 m² of NOX LOT EVERECO+ (3.0 mm). Results are calculated using TRACI 2.1.

Impact Category	Units	NOX LOT EVERECO+ (3.0 mm)
Ozone depletion	kg CFC-11 eq	5.2x10 ⁻⁶
Global warming	kg CO ₂ eq	55
Smog	kg O ₃ eq	3.4
Acidification	kg SO ₂ eq	0.24
Eutrophication	kg N eq	0.16
Fossil fuel depletion	MJ surplus	160

Table 13. Average 1-year use stage impacts for 1 m² of NOX LOT EVERECO+. Results are calculated using TRACI 2.1.

Impact Category	Units	Average 1-year Use and Maintenance Impacts
Ozone depletion	kg CFC-11 eq	2.9x10 ⁻⁸
Global warming	kg CO ₂ eq	0.15
Smog	kg O ₃ eq	8.5x10 ⁻³
Acidification	kg SO ₂ eq	8.7x10 ⁻⁴
Eutrophication	kg N eq	5.5x10 ⁻⁴
Fossil fuel depletion	MJ surplus	0.22

SUPPORTING TECHNICAL INFORMATION

Unit processes are developed with openLCA v1.7.4 software, drawing upon data from multiple sources. Primary data were provided by NOX Corporation for their manufacturing processes. The primary sources of secondary LCI data are from Ecoinvent v3.4.

Table 14. Data sources used for the LCA study.

Flow	Dataset	Data Source(s)	Publication Date
Product Materials			
Fiberglass Layer	market for acrylic acid acrylic acid Cutoff, U – GLO; market for glass fibre glass fibre Cutoff, U - GLO	Ecoinvent	2017
Polyolefin Mid-Bottom Layer	market for carbon black carbon black Cutoff, U – GLO; market for limestone, crushed, for mill limestone, crushed, for mill Cutoff, U – RoW; market for polypropylene, granulate polypropylene, granulate Cutoff, U – GLO; market for stearic acid stearic acid Cutoff, U – GLO; market for synthetic rubber synthetic rubber Cutoff, U – GLO; market for polyethylene, high density, granulate polyethylene, high density, granulate Cutoff, U - GLO; Secondary TPO Resin	Ecoinvent; SCS	2017; 2019
Polypropylene Balance Layer	market for polyethylene, low density, granulate polyethylene, low density, granulate Cutoff, U – GLO; market for polypropylene, granulate polypropylene, granulate Cutoff, U – GLO	Ecoinvent	2017
Polypropylene Print Film	market for polyethylene, low density, granulate polyethylene, low density, granulate Cutoff, U – GLO; market for polypropylene, granulate polypropylene, granulate Cutoff, U - GLO	Ecoinvent	2017
Polypropylene Wear Layer	market for polyethylene, low density, granulate polyethylene, low density, granulate Cutoff, U – GLO; market for polypropylene, granulate polypropylene, granulate Cutoff, U – GLO	Ecoinvent	2017
Polyurethane Coating Layer	market for acrylic acid acrylic acid Cutoff, U – GLO; market for chemical, organic chemical, organic Cutoff, U – GLO; market for methyl methacrylate methyl methacrylate Cutoff, U – GLO; Polyurethane {RoW} production Alloc Rec U; market for silica sand silica sand Cutoff, U - GLO	Ecoinvent; SCS	2017; 2018
Installation			
Adhesive	Acrylic binder, without water, in 34% solution state {GLO} market for Alloc Rec, U	Ecoinvent	2017
Maintenance			
Cleaner	Chemical, organic {GLO} market for Alloc Rec, U; Citric acid {GLO} market for Alloc Rec, U; Sodium hydroxide, without water, in 50% solution state {GLO} market for Alloc Rec, U; Sodium sulfite {GLO} market for Alloc Rec, U; Water, deionised, from tap water, at user {GLO} market for Alloc Rec, U	MSDS; Ecoinvent	2017
Water	Tap water {RoW} market for Alloc Rec, U	Ecoinvent	2017
Manufacturing			
Electricity	market for electricity, medium voltage electricity, medium voltage Cutoff, U - KR	Ecoinvent	2017
Light fuel oil	market for diesel, burned in building machine diesel, burned in building machine Cutoff, U - GLO	Ecoinvent	2017
Packaging			
Cardboard box	Corrugated board box {RoW} production Alloc Rec, U	Ecoinvent	2017
Pallets and boards	EUR-flat pallet production EUR-flat pallet Cutoff, U - RoW	Ecoinvent	2017
Wrapping	packaging film production, low density polyethylene packaging film, low density polyethylene Cutoff, U - RoW	Ecoinvent	2017
Strapping	market for polyester resin, unsaturated polyester resin, unsaturated Cutoff, U – GLO; market for extrusion, plastic film extrusion, plastic film Cutoff, U - GLO	Ecoinvent	2017
Transportation			
Truck	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO} market for Alloc Rec, U	Ecoinvent	2017
Truck (disposal)	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO} market for Alloc Rec, U	Ecoinvent	2017
Ship	Transport, freight, sea, transoceanic ship {GLO} market for Alloc Rec, U	Ecoinvent	2017

Data Quality

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 10 years old. All the primary data used represented an average of one year's worth of data collection. Manufacturer-supplied data are based on calendar year 2017.
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. Actual processes for upstream operations are primarily in the Republic of Korea, while downstream processes are primarily in the United States. Datasets used in the assessment are representative of US, Global, or "Rest-of-World" (average for all countries in the world with uncertainty adjusted). Datasets chosen are considered sufficiently similar to actual processes.
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 datasets, specific to the type of material or as a proxy, are used to represent the actual processes where primary data were not available.
Precision Measure of the variability of the data values for each data expressed (e.g. variance)	Precision of results are not quantified due to a lack of data. Manufacturer data, and representative data used for upstream processes 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 NOX LOT EVERECO+. In some instances, surrogate datasets used to represent upstream processes may be missing some data which is propagated in the model. Missing data represent less than 5% of the mass or energy flows.
Representativeness Qualitative assessment of the degree to which the data set reflects the true population of interest (i.e. geographical coverage, time period and technology coverage)	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 and were taken from Ecoinvent v3.4. Different portions of the product life cycle are equally considered.
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. The exact composition of each layer of the product is considered confidential and was made available to the LCA practitioner by the manufacturer.
Sources of the Data Description of all primary and secondary data sources	Data representing energy use at the manufacturing facility represent an annual average and are considered of good 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. A mass and energy balance check were completed during the data collection period. For secondary LCI datasets, the Ecoinvent v3.4 database is used.
Uncertainty of the Information Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the product and packaging is low. Primary data for upstream processes were not available; as such, the study relied upon use of existing representative datasets for these cases. These representative datasets contained relatively recent data (~10 years, or more recent), but in some instances lacked perfect geographical and technological representativeness. Uncertainty related to the impact assessment methods used in the study are relatively high since they lack characterization of thresholds or tipping points.

Allocation

For the raw material supply and all secondary datasets used for this LCA study, processes were modelled using the cut-off system model of Ecoinvent v3.4 database.

For the transport stage, impacts were allocated based on the mass of the material and distance transported to each facility.

This study follows the allocation guidelines of ISO-14044 and allocation rules specified in the PCR and sought to minimize the use of allocation wherever possible. For the manufacturing stage, mass allocation was deemed the most accurate and reproducible way of calculating resource use, emissions, and wastes. Primary data for resource use (e.g., electricity, natural gas, water, etc.), waste, and emissions released at the facility were allocated to the product on a mass-basis as a fraction of total annual production.

Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact must be included in the inventory. In the present study, except as noted, all known materials and processes were included in the life cycle inventory.

REFERENCES

1. ISO 14025: 2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures
2. ISO 14040: 2006 Environmental Management – Life cycle assessment – Principles and framework
3. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines
4. Oers, L. van (2015). CML-IA database, characterisation and normalisation factors for midpoint impact category indicators. Center of Environmental Science of Leiden University. CML-IA. <http://cml.leiden.edu/software/data-cmlia.html>
5. Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International. Version 2. 2014.
6. SCS Global Services. Life Cycle Assessment of NOX LOT EVERECO+ Resilient Floor Covering. May 2019. Final Report. Prepared for NOX KOREA.
7. SCS Type III Environmental Declaration Program: Program Operator Manual v10. April 2019. SCS Global Services
8. US EPA. Advancing Sustainable Materials Management: 2014 Fact Sheet. Assessing Trends in Material Generation, Recycling, and Disposal in the United States. November 2015.
9. US EPA. WARM Model Transportation Research - Draft. Memorandum from ICF Consulting to United States Environmental Protection Agency. September 7, 2004.
<http://epa.gov/epawaste/conservation/tools/warm/SWMGHGreport.html#background>.
10. Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8>



For more information, contact:

NOX Corporation

67 Hwanggeumtteul-ro, Bongsan-myeon,
Yesan-gun, Chungcheongnam-do, Korea
www.noxglobal.com | 82-2-520-7690



SCS Global Services

2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.50.452.8000 | fax +1.510.452.8001