Environmental Product Declaration

Smaragd

FORBO FLOORING SYSTEMS
RESILIENT FLOOR COVERING

FLOORING SYSTEMS

Smaragd - a well-proven material for decades. The heterogeneous structure gives the material extraordinary properties, resistant to any challenge faced by modern floor. In addition, the unique upper layer of PUR Pearl ™ provides even better protection and at the same time does not require laborious maintenance during its life cycle.

Forbo was the first flooring manufacturer to publish a complete Life Cycle Assessment (LCA) report verified by CML in 2000. In addition, Forbo is now publishing Environmental Product Declarations (EPD) for all products including full LCA reports. This EPD uses recognized flooring Product Category Rules and includes additional information to show the impacts on human health and eco-toxicity. By offering the complete story, we hope that our stakeholders will be able to use this document as a tool that will translate the environmental performance of Smaragd into true value and benefits for all our customers and stakeholders alike.

For more information visit:
www.forbo-flooring.com

UL CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

FLOORING SYSTEMS

Smaragd
Resilient Floor Covering

According to ISO 14025 & EN 15804

This declaration is an environmental product declaration in accordance with ISO 14025. This EPD does not guarantee that any performance benchmarks, including environmental performance benchmarks, are met. EPDs are intended to compliment Type I environmental performance labels. EPDs provide LCA-based information and additional information on the environmental aspects of products and assist purchasers and users to make informed comparisons between products. EPDs are not comparative assertions. EPDs encourage improvement of environmental performance and provide information for assessing the environmental impacts of products over their life cycle. EPDs not based on an LCA covering all life cycle stages, or based on a different PCR, are examples of declarations that have limited comparability. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment 333 Pfingsten Road Northbrook, IL 60611
DECLARATION HOLDER	Forbo Flooring B.V. Industrieweg 12 P.O. Box 13 NL-1560 AA Krommenie
DECLARATION NUMBER	12CA64879.119.1
DECLARED PRODUCT	Smaragd
REFERENCE PCR	Flooring: Carpet, Resilient, Laminate, Ceramic, and Wood (NSF 2012)

DATE OF ISSUE	11 October 2013
PERIOD OF VALIDITY	5 Years

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

The PCR review was conducted by:	NSF International
	Accepted by PCR Review Panel
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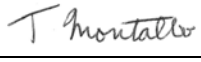
This declaration was independently verified in accordance with ISO 14025 and EN 15804 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	
	Loretta Tam, ULE EPD Program Manager
This life cycle assessment was independently verified in accordance with ISO 14044, EN 15804 and the reference PCR by:	
	Trisha Montalbo, PE International

Product Definition

Product Classification and Description

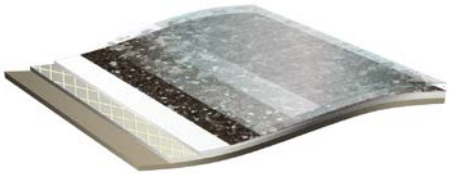
This declaration covers the Smaragd collection of Project Vinyl floorcoverings. The Smaragd collection consists of a range of products of different designs and colors. Smaragd sheet from Forbo Flooring is a resilient floor covering complying with all the requirements of EN-ISO 10582: Resilient floor coverings – Heterogeneous polyvinyl chloride floor coverings - Specification. The key raw materials include PVC, plasticizer, mineral filler, stabilizers and glass fiber.

Smaragd is produced by Forbo Flooring and is sold worldwide.

This declaration refers to Smaragd sheet of 2.0mm nominal thickness with a 0,70mm wear layer.

Smaragd is built up in 5 layers:

Figure 1: Typical construction



1. **Lacquer surface:** This PU lacquer coating for easy cleaning & maintenance gives enhanced protection against scuffing, scratching, dirt pick up and staining.
2. **Wear layer:** The 0.70mm wear layer meets the requirement for Type 1 wear layer according to EN-ISO10582. This topcoat layer is generally transparent but for certain ranges will be pigmented and may also contain design enhancing decorative PVC chips or spheres.
3. **Printed layer:** The decorative design is printed, using environmentally friendly water-based inks, on to a thin white PVC plastisol coating. Printed design is not required with pigmented wear layers.
4. **Intermediate layer:** Non-woven glass fleece that is impregnated with a highly filled PVC plastisol to give the product strength & excellent dimensional stability.
5. **Backing layer**: Spreaded layer.

Range of Applications

Smaragd is classified in accordance with EN-ISO 10582 to be installed in the following use areas defined in EN-ISO 10874:

Area of application	
Commercial	Class 34 
Industrial	Class 43 

forbo FLOORING SYSTEMS

Smaragd
Resilient Floor Covering

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Product Standards

The products considered in this EPD have the following technical specifications:

- Meets or exceeds all technical requirements in EN-ISO 10582 Resilient floor coverings – Heterogeneous polyvinyl chloride floor coverings - Specification

CE

Smaragd meets the requirements of EN 14041

EN 13501-1	Reaction to fire	B_{fl} – s1
EN 13893	Slip resistance	DS: ≥ 0,30
EN 1815	Body voltage	< 2 kV
EN ISO10456	Thermal conductivity	0,25 W/mK

Accreditations

- ISO 9001 Quality Management System
- ISO 14001 Environmental Management System

Delivery Status

Table 1: Specification of delivered product

Characteristics	Nominal Value	Unit
Product thickness	2.00	mm
Product Weight	2.89	kg/m^2
Rolls Width Length	2.00 25	m

Material Content

Material Content of the Product

Table 2: Composition of Smaragd

Component	Material	Availability	Amount [%]	Origin of raw material
Binder	PVC	Non-renewable – limited	42	Europe
	DINP & Dibenzoates	Non-renewable - limited	17	Europe
Filler	Calcium carbonate	Abundant mineral	30	Russia
Stabilizers and process additives	Epoxidized esters & proprietary mixtures & lubricants	Non-renewable - limited	8	Europe
Carrier	Glass fiber tissue	Non-renewable - limited	1.5	Russia
Pigments	Various pigments	Non-renewable - limited	1	Russia
Finish	UV lacquer	Non-renewable - limited	<0.5	Europe

Production of Main Materials

PVC: Polymer which is produced by the polymerization of vinyl chloride monomer.

Plasticizers: Plasticizer is obtained by esterification of an alcohol and acid. Plasticizer is added to increase the flexibility, durability and longevity of the floor covering.

Stabilizer Ba/Zn: Mixed metal stabilizer made from Barium and Zinc stearate. It is used to avoid PVC degradation during processing at relative high temperature.

Calcium carbonate : An abundant mineral found in all parts of the world as the chief substance in rocks (i.e., marble and limestone). It can be ground to varying particle sizes and is widely used as filler.

Glass fleece: Glass fibers are mixed with a binder to produce a glass fleece which is used as a substrate for floor coverings and imparts excellent dimensional stability to the finished product.

Various chemicals:

- **Lacquer** : Solid UV coating
- **Inks:** water-based gravure inks.

Production of the Floor Covering

Smaragd is produced in stages:

- Preparation of PVC plastisols (mixture of PVC, plasticizer and additives, may also contain filler and pigments)
- Impregnation of the glass fleece with a highly filled plastisol followed by the application of a thin white plastisol coating.
- Rotogravure printing, if required, to produce wood, stone or abstract designs.
- Application of PVC plastisol topcoat and PU lacquer. PVC topcoat may be transparent or pigmented and may also contain decorative PVC particles depending on the design type. After fusion at ~195^{0}C the topcoat is mechanically embossed to enhance the decorative effect.
- A spreaded back layer is then applied to the product.
- The finished product is then trimmed, inspected and cut into saleable rolls (nominal length – 25 meters).

Health, Safety and Environmental Aspects during Production

- ISO 14001 Environmental Management System

Production Waste

Rejected material and the cuttings of the trimming stage are recycled externally as it is, currently, not possible to reuse this waste internally. Packaging materials are collected separately and externally recycled.

Delivery and Installation of the Floor Covering

Delivery

A worldwide distribution by truck and container ship is considered. On average every square meter of Smaragd is transported as follows:

Transport distance 40 t truck	875 km
Transport distance 7.5t truck (Fine distribution)	300 km
Capacity utilization trucks (including empty runs)	85 %
Transport distance Ocean ship	0 km
Capacity utilization Ocean ship	48%

Since Smaragd is mainly sold in Russia on average there is no significant transport distance for the distribution of Smaragd by Ocean ship.

Installation

Because of the specific techniques used during the installation of Smaragd approximately 6% of the material is cut off as installation waste. For installation of Smaragd on the floor a scenario has been modeled assuming 0.30 kg/m^2 of adhesive is applied to the sub-floor. Waste during the installation process may be recycled or disposed of via landfill or incineration.

Health, Safety and Environmental Aspects during Installation

Forbo flooring recommends to use (low) zero emission adhesives for installing Smaragd floorcovering.

Waste

Waste during the installation process may be disposed of via land fill or thermally recycled in a waste incineration plant.

Packaging

Cardboard tubes and packaging paper can be collected separately and should be used in a local recycling process. In the calculation model, 100% incineration is taken into account for which there is a credit received.

Use stage

The service lifetime of a floor covering for a certain application on a floor is too widespread to give one common number. For this EPD model the reference service lifetime (RSL) is set to one year. This means that all impacts for the use phase are based on the cleaning and maintenance model for one year. Depending on the area of use, the technical lifetime advised by the manufacturer and the estimated time on the floor by the customer, the service lifetime can be determined. The use phase impacts should be calculated with the foreseen service life to arrive at the total environmental impact.

Cleaning and Maintenance

Level of use	Cleaning Process	Cleaning Frequency	Consumption of energy and resources
Commercial/Residential	Vacuuming	Twice a week	Electricity
	Wet Cleaning	Once a week	Hot water Neutral detergent

For the calculations the following cleaning regime is considered:

- Dry cleaning with a 1.5 kW vacuum cleaner for 0.21 min/m^2, twice a week. This equates to 0.55 kWh/m^2*year.
- Once a week wet cleaning with 0.062 l/m^2 water and 0.0008 kg/m^2 detergent. This result in the use of 3.224 l/m^2*year water and 0.04 kg/m^2*year detergent. The wet cleaning takes place without power machine usage. Waste water treatment of the arising waste water from cleaning is considered (Data sourced from Forbo GABI model).

The cleaning regime that is recommended in practice will be 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. The use of an entrance mat of at least four steps will reduce the cleaning frequency.

The cleaning regime used in the calculations is suitable for high traffic areas.

Prevention of Structural Damage

All newly laid floor covering should be covered and protected with a suitable non-staining protective covering if other building activities are still in progress. Use protective feet on chairs and tables to reduce scratching. Castor wheels should be suitable for resilient floor coverings

Health Aspects during Usage

Smaragd complies with:

- AgBB requirements
- CHPS section 01350

End of Life

The deconstruction of installed Smaragd from the floor is done mechanically and the electrical energy needed for this is estimated to be 0.03 kWh/sqm. This amount of energy is included in the calculations. For the End of Life stage, 40% landfill and 60% incineration is taken into account. The average distance to the incineration plant or landfill facility per lorry is set to 200 km.

Life Cycle Assessment

A full Life Cycle Assessment has been carried out according to ISO 14040 and ISO 14044.

The following Life Cycle Stages are assessed :

- Production Stage (Raw material acquisition, transportation to Manufacturing and Manufacturing)
- Transport Gate to User
- Installation Stage
- Use Stage
- End of Life Stage

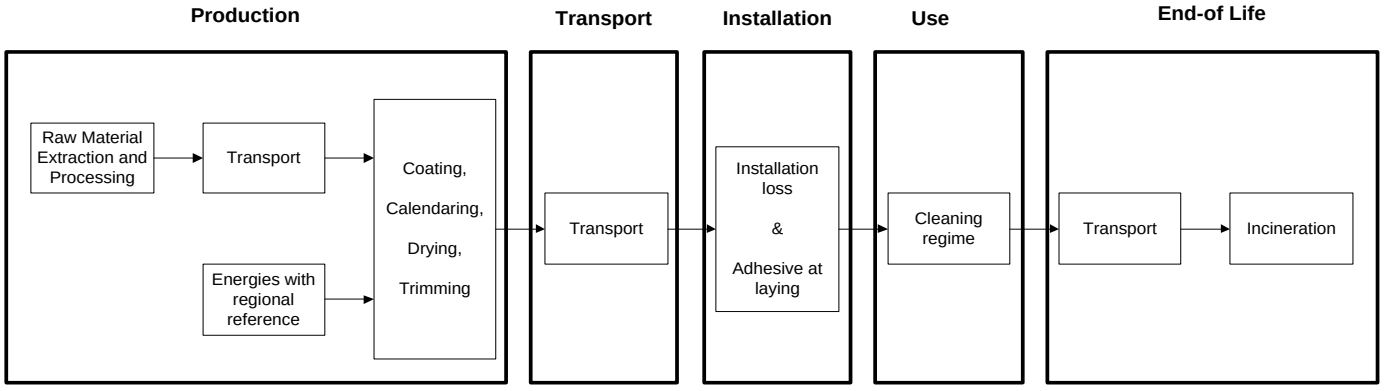


Figure 3: Flow chart of the Life Cycle Assessment

Description of the Declared Functional Unit

The functional unit is one square meter of installed product and the use stage is considered for one year of service life.

Cut off Criteria

The cut-off criteria shall be 1% of renewable and non-renewable primary energy usage and 1% of the total mass of the unit process. The total neglected input flows per module shall be a maximum of 5% of energy usage and mass.

In practice, in this assessment, all data from the production data acquisition are considered, i.e. all raw materials used as per formulation, use of water, electricity and other fuels, the required packaging materials, and all direct production waste. Transport data on all considered inputs and output material are also considered.

Allocations

In the present study some allocations have been made. Detailed explanations can be found in the chapters below.

Co-product Allocation

No co-product allocation occurs in the product system.

Allocation of Multi-input Processes

The Production and End of Life stage include incineration plants. In these processes different products are treated together within a process. The allocation procedures followed in these cases are based on a physical classification of the mass flows or calorific values.

Credits from energy substitution are allocated to the production stage, because the gained energy from energy substitution is lower than the energy input in this stage. The same quality of energy is considered.

Allocation procedure of reuse, recycling and recovery

The installation waste and end of life waste is fed into incineration processes. Incineration processes include cogeneration processes which give thermal and power energy as outputs. It is assumed that this recovered energy offsets that produced by the European average grid mix and thermal energy generation from natural gas.

Description of the allocation processes in the LCA report

The description of allocation rules in of this LCA report meets the requirements of the PCR.

Background Data

As a general rule, specific data derived from specific production processes or average data derived from specific production processes have been used as the first choice as a basis for calculating an EPD.

For life cycle modeling of the considered products, the GaBi 6 Software System for Life Cycle Engineering, developed by PE INTERNATIONAL AG has been used. All relevant LCA datasets are taken from the GaBi 6 software database. The datasets from the database GaBi are documented in the online documentation. To ensure comparability of results in the LCA, the basic data of GaBi database were used for energy, transportation and auxiliary materials.

Data Quality

The requirements for data quality and LCA data correspond to the specifications of the PCR.

Foreground data are based on 1 year averaged data (year 2012). The reference ages of LCA datasets vary but are given in the table in the Appendix. The time period over which inputs to and outputs from the system is accounted for is 100 years from the year for which the data set is deemed representative. The technological LCA of the collected data reflects the physical reality of the declared product. The datasets are complete, conform to the system boundaries and the criteria for the exclusion of inputs and outputs and are geographical representative for the supply chain of Forbo flooring.

For life cycle modeling of the considered products the GaBi 6 Software System for Life Cycle Engineering, developed by PE INTERNATIONAL AG, is used. All relevant LCA datasets are taken from the GaBi 6 software database. The last revision of the used data sets took place within the last 10 years.

System Boundaries

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

Transport and Installation Stage includes provision of all materials, products and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the construction stage. These information modules also include all impacts and aspects related to any losses during this construction stage (i.e. production, transport, and waste processing and disposal of the lost products and materials). For the transportation a worldwide distribution is considered.

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

End of Life Stage includes provision and all transports, provision of all materials, products and related energy and water use. It also includes any declared benefits and loads from net flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state in the form of reuse, recovery and/or recycling potentials.

Power mix

The selection of LCA data for the electricity generation is in line with the PCR. The products are manufactured in Kaluga, Russia. The GaBi 6 EU27 power dataset has therefore been used (reference year 2009).

CO_2-Certificates

No CO_2-certificates are considered in this study.

Life Cycle Inventory Analysis

The total primary energy for one square meter installed Smaragd is presented in table 3 with their specific energy resources.

Table 3: Primary energy for all life cycle stages for Smaragd for one year

Non-renewable primary energy by resources	Unit	Total Life cycle (MJ)	Total Life cycle (%)	Production	Transport	Installation	Use (1 yr)	End of Life
Total non-renewable primary energy	MJ	1.91E+02	100%	1.74E+02	1.85E+00	1.23E+01	5.84E+00	-2.84E+00
Crude oil	MJ	7.00E+01	36.7%	6.04E+01	1.69E+00	4.72E+00	6.30E-01	2.53E+00
Hard coal	MJ	1.18E+01	6.2%	8.97E+00	0.00E+00	2.20E-01	9.80E-01	1.57E+00
Lignite	MJ	1.08E+01	5.7%	9.01E+00	0.00E+00	2.70E-01	7.40E-01	7.80E-01
Natural gas	MJ	8.31E+01	43.6%	8.27E+01	1.40E-01	6.96E+00	1.74E+00	-8.44E+00
Uranium	MJ	1.51E+01	7.9%	1.25E+01	1.00E-02	1.00E-01	1.74E+00	7.30E-01
Renewable primary energy by resources	**Unit**	**Total Life cycle (MJ)**	**Total Life cycle (%)**	**Production**	**Transport**	**Installation**	**Use (1 yr)**	**End of Life**
Total renewable primary energy	MJ	1.26E+01	100%	1.19E+01	7.00E-02	1.10E-01	7.90E-01	-2.50E-01
Geothermical	MJ	4.00E-02	0.3%	3.00E-02	0.00E+00	0.00E+00	1.00E-02	0.00E+00
Hydro power	MJ	1.91E+00	15.1%	1.64E+00	0.00E+00	-2.00E-02	3.20E-01	-3.00E-02
Solar energy	MJ	8.39E+00	66.4%	8.09E+00	7.00E-02	8.00E-02	2.30E-01	-8.00E-02
Wind power	MJ	2.19E+00	17.3%	2.06E+00	0.00E+00	5.00E-02	2.30E-01	-1.40E-01

The total amount of renewable and non-renewable primary energy is predominated by the production stage for a one year usage; within the production stage the main contributors are the raw material production and energy generation.

Waste and non-renewable resource consumption

In table 4 the non-renewable resource consumption and waste production is shown for all life cycle stages for a one year usage.

Table 4: Waste categories and non-renewable resources for Smaragd (one year)

Wastes	Unit	Total Life cycle	Production	Transport	Installation	Use (1yr)	End of Life
Hazardous waste	[kg]	5.07E-03	2.37E-03	0.00E+00	2.70E-03	0.00E+00	0.00E+00
Non-hazardous waste	[kg]	1.54E+01	1.28E+01	6.57E-03	6.30E-01	1.12E+00	7.73E-01
Radioactive waste	[kg]	5.91E-03	4.97E-03	2.57E-06	1.98E-04	7.12E-04	2.39E-05
Resources	**Unit**	**Total Life cycle**	**Production**	**Transport**	**Installation**	**Use (1yr)**	**End of Life**
Nonrenewable resources	[kg]	1.98E+01	1.51E+01	1.00E-02	5.30E-01	1.13E+00	3.02E+00

Life Cycle Assessment

In table 5 the environmental impacts for one lifecycle are presented for Smaragd. In table 6 the environmental impacts are presented for all the lifecycle stages.

Table 5: Results of the LCA – Environmental impacts one lifecycle (one year) – Smaragd

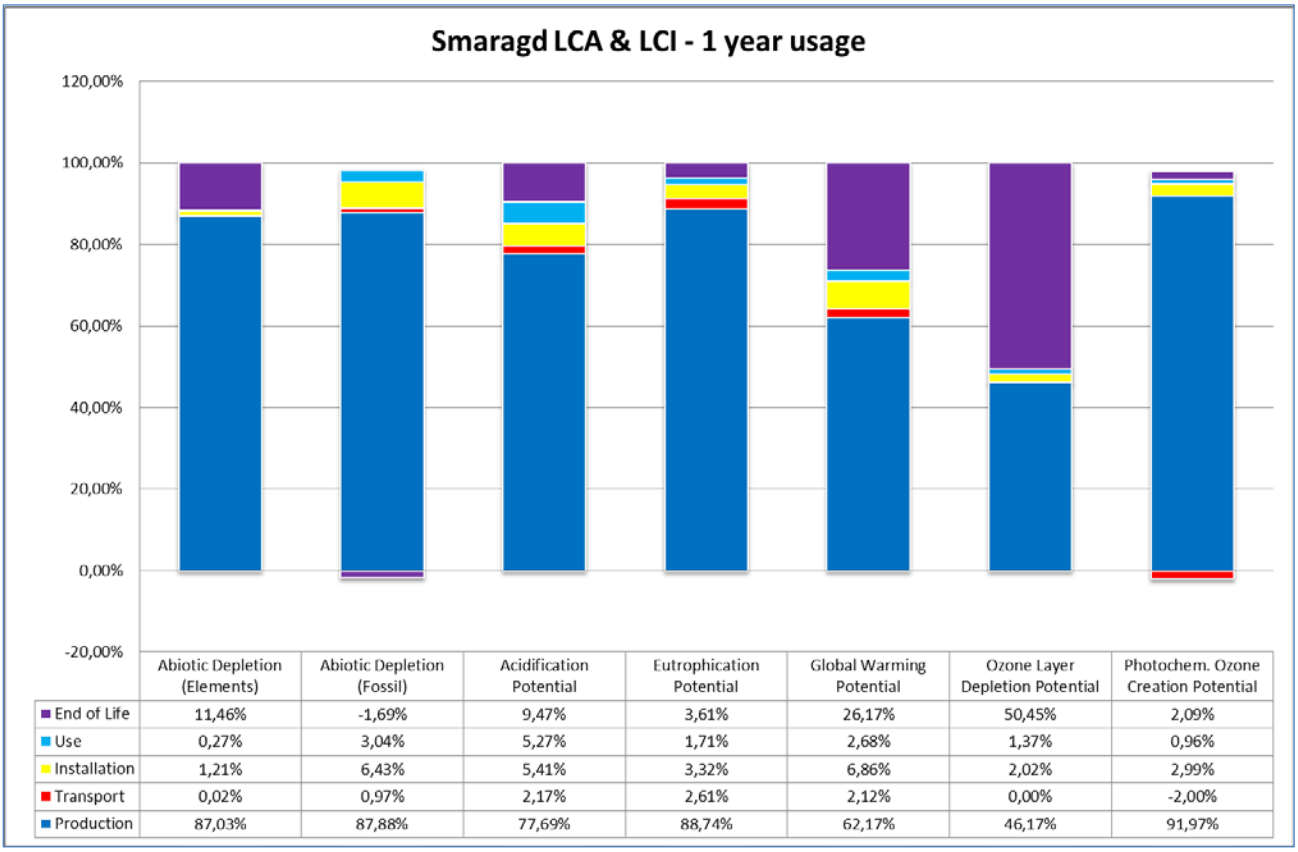
Impact Category : CML 2001 – Nov. 2010	Smaragd	Unit
Global Warming Potential (GWP 100 years)	1.20E+01	kg CO2-Equiv.
Ozone Layer Depletion Potential (ODP. steady state)	1.67E-07	kg R11-Equiv.
Acidification Potential (AP)	2.56E-02	kg SO2-Equiv.
Eutrophication Potential (EP)	4.84E-03	kg Phosphate-Equiv.
Photochem. Ozone Creation Potential (POCP)	9.18E-03	kg Ethene-Equiv.
Abiotic Depletion Potential Elements (ADPE)	2.35E-05	kg Sb-Equiv.
Abiotic Depletion Potential Fossil (ADPF)	1.84E+02	[MJ]

Table 6: Results of the LCA – Environmental impact for Smaragd (one year)

Impact Category : CML 2001 – Nov. 2010	Unit	Production	Transport	Installation	Use (1yr)	End of Life
Global Warming Potential	kg CO2-Equiv.	7.46E+00	2.54E-01	8.23E-01	3.22E-01	3.14E+00
Ozone Layer Depletion Potential	kg R11-Equiv.	7.73E-08	2.33E-12	3.38E-09	2.30E-09	8.45E-08
Acidification Potential	kg SO2-Equiv.	1.99E-02	5.54E-04	1.38E-03	1.35E-03	2.42E-03
Eutrophication Potential	kg PSO4-Equiv.	4.29E-03	1.26E-04	1.61E-04	8.29E-05	1.75E-04
Photochem. Ozone Creation Potential	kg Ethene-Equiv.	8.80E-03	-1.91E-04	2.86E-04	9.17E-05	2.00E-04
Abiotic Depletion Elements	kg Sb-Equiv.	2.04E-05	4.97E-09	2.85E-07	6.36E-08	2.69E-06
Abiotic Depletion Fossil	MJ	1.67E+02	1.85E+00	1.22E+01	5.78E+00	-3.21E+00

The relative contribution of each process stage to each impact category for Smaragd is shown in figure 4.

Figure 4: relative contribution of each process stage to each impact category for Smaragd for a one year usage.



	Abiotic Depletion (Elements)	Abiotic Depletion (Fossil)	Acidification Potential	Eutrophication Potential	Global Warming Potential	Ozone Layer Depletion Potential	Photochem. Ozone Creation Potential
End of Life	11,46%	-1,69%	9,47%	3,61%	26,17%	50,45%	2,09%
Use	0,27%	3,04%	5,27%	1,71%	2,68%	1,37%	0,96%
Installation	1,21%	6,43%	5,41%	3,32%	6,86%	2,02%	2,99%
Transport	0,02%	0,97%	2,17%	2,61%	2,12%	0,00%	-2,00%
Production	87,03%	87,88%	77,69%	88,74%	62,17%	46,17%	91,97%

Interpretation

The interpretation of the results has been carried out considering the assumptions and limitations declared in the EPD, both methodology- and data-related for a one year usage.

In most of the impact categories (ADPE, ADPF, AP, EP, GWP and POCP) the production stage has the main contribution to the overall impact and except for POCP the raw material supply is the key contributor with a share of 69 – 99%. For POCP the share of the Forbo manufacturing stage is 69%, caused by the use of energy during the manufacturing of Smaragd.

For the transportation stage a small contribution comes from the categories AP, EP and GWP in which the trucks used for the distribution are the major contributors.

For GWP, AP, EP, POCP and ADPF the adhesive for the flooring installation has an impact of approximately 3 – 7% of the total. Also for the use stage these are the main impact categories, mainly caused by the use of electricity for cleaning.

At the End of Life stage the main impact categories are AP, ADPE, GWP and ODP, this is mainly due to the fact that 60% of the waste is incinerated.

Additional Environmental Information

To be fully transparant Forbo Flooring does not only want to declare the environmental impacts required in the PCR, but also the impacts on human health and eco-toxicity. Furthermore the outcome of the calculations according to the european Standard EN15804 are published in this section.

Toxicity

For this calculations the USEtoxTM model is used as being the globally recommended preferred model for characterization modeling of human and eco-toxic impacts in LCIA by the United Nations Environment Programme SETAC Life Cycle Initiative.

According to the "ILCD Handbook: Recommendations for Life Cycle Impact Assessment in the European context" the recommended characterization models and associated characterization factors are classified according to their quality into three levels:

- Level I (recommended and satisfactory),
- level II (recommended but in need of some improvements)
- level III (recommended, but to be applied with caution).

A mixed classification sometimes is related to the application of the classified method to different types of substances.

USEtoxTM is classified as Level II / III, unlike for example the CML impact categories which are classified as Level I.

Table 7: Results of the LCA – Environmental impacts one lifecycle (one year) – Smaragd

Impact Category : USEtox	Smaragd	Unit
Eco toxicity	1.50E+00	PAF m3.day
Human toxicity, cancer	1.04E-08	Cases
Human toxicity, non-canc.	2.65E-06	Cases

In the following table the impacts are subdivided into the lifecycle stages.

Table 8: Results of the LCA – Environmental impact for Smaragd (one year)

Impact Category : USEtox	Unit	Production	Transport	Installation	Use (1yr)	End of Life
Eco toxicity	PAF m3.day	1.45E+00	1.67E-02	1.22E-02	2.78E-02	-4.28E-03
Human toxicity, cancer	cases	9.91E-09	6.94E-11	2.30E-10	2.66E-10	-2.99E-11
Human toxicity, non-canc.	cases	2.56E-06	3.26E-08	1.60E-08	5.50E-08	-1.32E-08

Interpretation

The interpretation of the results has been carried out considering the assumptions and limitations declared in the EPD, both methodology- and data-related for a one year usage.

In all the Toxicity categories the production stage is the main contributor to the total overall impact. The raw material supply has a share of more than 92% of the production stage, therefore the choice of raw materials can highly influence the Toxicity categories.

The Use stage has a minor impact of 2-3% for all three impact categories. This is mainly due to the use of electricity for the cleaning of the floor. The used cleaning regime of vacuuming twice a week is very conservative and will in practice most of the times be lower.

EN15804 Results

In this section the calculations have been conducted and verified according to the requirements of the European Standard EN 15804. In addition, calculations followed the document "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report", however, Part A was not included as a part of the verification.

Table 9: Results of the LCA – Environmental impact for Smaragd (one year)

		Manufacturing	Installation		Use (1yr)	End of Life				Credits
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B2**	**C1**	**C2**	**C3**	**C4**	**D**
GWP	[kg CO2-Equiv.]	7.46E+00	2.54E-01	9.61E-01	3.22E-01	1.70E-02	7.70E-02	2.82E+00	2.27E-01	-1.39E-01
ODP	[kg CFC11-Equiv.]	7.73E-08	2.33E-12	3.43E-09	2.30E-09	4.31E-09	1.60E-12	7.63E-08	3.85E-09	-5.64E-11
AP	[kg SO2-Equiv.]	1.99E-02	5.54E-04	1.73E-03	1.35E-03	1.16E-04	3.86E-04	1.83E-03	8.93E-05	-3.51E-04
EP	[kg PO43-- Equiv.]	4.29E-03	1.26E-04	1.84E-04	8.29E-05	4.21E-06	9.30E-05	5.65E-05	2.09E-05	-2.33E-05
POCP	[kg Ethen Equiv.]	8.80E-03	-1.91E-04	3.14E-04	9.17E-05	5.96E-06	4.12E-05	9.13E-05	6.13E-05	-2.82E-05
ADPE	[kg Sb Equiv.]	2.04E-05	4.97E-09	2.96E-07	6.36E-08	1.17E-09	3.54E-09	2.69E-06	-2.17E-09	-1.14E-08
ADPF	[MJ]	1.67E+02	1.85E+00	1.46E+01	5.78E+00	3.26E-01	1.05E+00	-4.73E+00	1.37E-01	-2.35E+00

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

Table 10: Results of the LCA – Resource use for Smaragd (one year)

		Manufacturing	Installation		Use (1yr)	End of Life				Credits
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B2**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	-	-	-	-	-	-	-	-	-
PERM	[MJ]	-	-	-	-	-	-	-	-	-
PERT	[MJ]	1.19E+01	7.23E-02	2.90E-01	7.88E-01	2.55E-02	6.24E-02	-2.94E-01	-4.18E-02	-1.84E-01
PENRE	[MJ]	-	-	-	-	-	-	-	-	-
PENRM	[MJ]	-	-	-	-	-	-	-	-	-
PENRT	[MJ]	1.74E+02	1.85E+00	1.46E+01	5.84E+00	3.30E-01	1.05E+00	-4.38E+00	1.64E-01	-2.35E+00
SM	[kg]	-	-	-	-	-	-	-	-	-
RSF	[MJ]	2.15E-03	1.17E-05	2.61E-04	9.54E-05	0.00E+00	7.84E-06	-1.79E-04	-8.49E-06	-3.37E-05
NRSF	[MJ]	2.25E-02	1.22E-04	2.73E-03	9.99E-04	0.00E+00	8.20E-05	-1.88E-03	-8.90E-05	-3.53E-04
FW	[kg]	2.01E+01	8.02E-02	3.07E+00	5.28E+00	-7.97E-02	6.01E-02	-2.56E+00	-8.66E-01	-5.14E-01

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Table 11: Results of the LCA – Output flows and Waste categories for Smaragd (one year)

		Manufacturing	Transport	Installation	Use (1yr)	End of Life/credits				
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B2**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	2.37E-03	0.00E+00	2.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	[kg]	1.28E+01	6.57E-03	6.30E-01	1.12E+00	6.04E-02	6.52E-03	9.95E-01	-3.87E-02	-2.50E-01
RWD	[kg]	4.97E-03	2.57E-06	1.98E-04	7.12E-04	5.41E-05	1.51E-06	1.74E-04	-4.37E-05	-1.62E-04
CRU	[kg]	-	-	-	-	-	-	-	-	-
MFR	[kg]	-	-	-	-	-	-	-	-	-
MER	[kg]	-	-	-	-	-	-	-	-	-
EE Power	[MJ]	-	-	1.66E-01	-	-	-	1.37E+00	-	-
EE Thermal energy	[MJ]	-	-	3.10E-01	-	-	-	1.08E+01	-	-

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy per energy carrier

Interpretation

The interpretation of the environmental impacts calculated according to EN 15804 are similar to the interpretation according to ISO 14025 on page 12. A more detailed interpretation is published in the appendix.

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EN 15804	EN 15804: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products
ISO 24011	Resilient floor coverings - Specification for plain and decorative linoleum
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EN-ISO 10874	Resilient, textile and laminate floor coverings - Classification