Environmental Product Declaration

according to ISO 14025

DESSO
The Floor is Yours

Carpet tiles 100% PA6

- **Tufted with 100 % polyamide 6 yarns**
- **Modified bitumen secondary backing**

Deklarationsnummer
EPD-DES-2011111-E

Institut Bauen und Umwelt e.V.
http://www.bau-umwelt.com

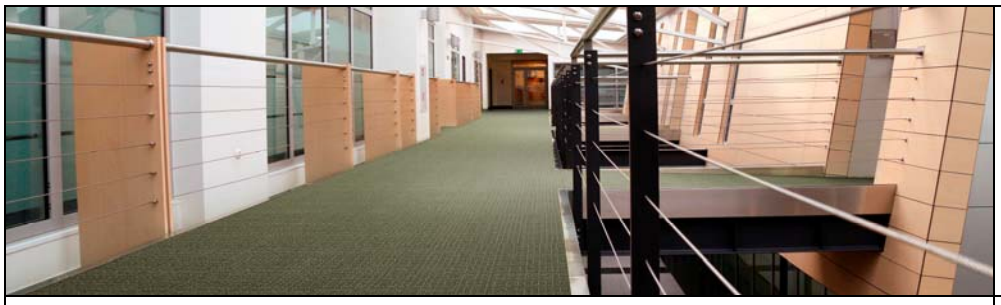
Institut Bauen
und Umwelt e.V.

Short version

Umwelt-Produktdeklaration

Environmental Product Declaration

Institut Bauen und Umwelt e.V. www.bau-umwelt.com	Program operator
Gemeinschaft umweltfreundlicher Teppichboden (GUT) e.V. Schönebergstr. 2; 52068 Aachen, Germany mail@gut-ev.de www.gut-ev.org	Program facilitator
DESSO BV Taxandriaweg 15 5142 PA Waalwijk, The Netherlands info@desso.com www.desso.com	Declaration holder
EPD-DES-2011111-E	Declaration number
Carpet tiles, tufted with 100% polyamide 6 yarns and modified bitumen secondary backing. **This group is represented by the products Tempra, Stratos, Libra Lines, Air Master®, Scape, Mila and products with the same construction as listed in chapter 8.1 of the long version.** This declaration is an Environmental Product Declaration according to /ISO 14025/ and describes the environmental performance of the floor coverings indicated herein. It is designed to foster the development of ecological and healthy building. In this validated declaration, the relevant environmental data are disclosed. The declaration is based on the PCR document "Floor coverings", year 2008-01.	Declared building product
This validated declaration authorizes the use of the official stamp of the Institut Bauen und Umwelt (IBU). It is valid for a period of three years from the date of issue exclusively for the indicated products with a valid PRODIS license. The contents and validity of the license may be checked online via www.pro-dis.info by using the PRODIS license number (see long version chapter 0.4). The owner of the declaration shall be liable for the underlying information and verifications.	Validity
The declaration is complete and furnishes details of: - the product definition and relevant building-physics-related information - the raw materials and origin of the raw materials - the descriptions of the product manufacture - the information on product processing - the information on the use stage, extraordinary influences and end-of-life stage - the results of the life cycle assessment - the description of the benefits beyond system boundaries	Content of the declaration
03 November 2011	Date of issue
Prof. Dr. Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt)	Signatures
This declaration and the rules on which it is based have been examined in accordance with /ISO 14025/ by the independent Committee of Experts (CoE).	Examination of the declaration
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the CoE) / Dr. Eva Schmincke (CoE-appointed verifier)	Signatures



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Product description

The declaration covers a group of textile floor coverings with following characteristics:

Carpet tiles, tufted with 100% polyamide 6 yarns, solution dyed or continuous piece dyed, with PES/PA primary backing and modified bitumen secondary backing containing a glass reinforcement layer, covered by a polypropylene non-woven fleece.

Subject to the effective pile weight the products are allocated to the luxury classes LC1 or LC5, as defined by EN1307. Table 1 shows the classification of the products.

Table 1: **Luxury classes for the products covered**

	Unit	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Effective pile weight	g/m²	290	345	360	400	470	545
Luxury rating		LC1	LC1	LC2	LC1	LC2	LC2

Range of application

As indicated on the PRODIS label, the textile floor covering may be used in the commercial area.
Use Classification: Class 33 – commercial heavy use
Suitability for additional uses is also indicated on the PRODIS label (www.pro-dis.info).

Scope of the life cycle assessment

The **Life Cycle Assessment (LCA)** was carried out according to /ISO 14040/ seq. following the requirements of the IBU guideline for type III declarations. The data reference consisted of specific data provided by member companies and of data from the "GaBi 4" database. Specific product data for this declaration originate from DESSO (the manufacturer) and its suppliers.

The life cycle assessment covers

- Part 1: Production stage including the supply chains (from cradle to factory gate)
- Part 2: Delivery/installation, use
- Part 3: End-of-life stage

Result of the life cycle assessment

The impact results of the life cycle assessment are shown in table 2 including credits. Further explanation, underlying conditions, a separation of impacts and credits can be found in chapter 7 of this document.

Table 2: **Results of the LCA**

Evaluation value	Unit per m²	Part 1 – Product manufacture						Part 2 – Delivery/installation, use see chapter 7.9.2 and 7.9.3	Part 3 – End-of-life stage *					
		Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila		Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Primary energy non-renewable	[MJ]	173.9	175.1	155.7	168.6	183.9	204.8		-53.1	-57.5	-52.9	-55.9	-57.8	-60.5
Primary energy renewable	[MJ]	8.6	4.6	4.3	4.5	4.8	5.2		-0.18	-0.19	-0.18	-0.18	-0.19	-0.19
Abiotic depletion (ADP)	[kg Sb-eqv.]	$7.7 \cdot 10^{-2}$	$7.6 \cdot 10^{-2}$	$6.8 \cdot 10^{-2}$	$7.4 \cdot 10^{-2}$	$8.0 \cdot 10^{-2}$	$8.9 \cdot 10^{-2}$		$-2.5 \cdot 10^{-2}$	$-2.7 \cdot 10^{-2}$	$-2.5 \cdot 10^{-2}$	$-2.6 \cdot 10^{-2}$	$-2.7 \cdot 10^{-2}$	$-2.9 \cdot 10^{-2}$
Global warming potential (GWP 100)	[kg CO2-eqv.]	9.88	10.08	8.75	9.64	10.92	12.64		0.97	1.06	0.98	1.02	1.02	1.02
Ozone depletion potential (ODP)	[kg R11-eqv.]	$5.8 \cdot 10^{-7}$	$6.3 \cdot 10^{-7}$	$5.9 \cdot 10^{-7}$	$6.1 \cdot 10^{-7}$	$6.5 \cdot 10^{-7}$	$7.1 \cdot 10^{-7}$		$-8.6 \cdot 10^{-8}$	$-9.3 \cdot 10^{-8}$	$-8.6 \cdot 10^{-8}$	$-9.1 \cdot 10^{-8}$	$-9.4 \cdot 10^{-8}$	$-9.9 \cdot 10^{-8}$
Acidification potential (AP)	[kg SO2-eqv.]	$3.3 \cdot 10^{-2}$	$3.5 \cdot 10^{-2}$	$3.1 \cdot 10^{-2}$	$3.4 \cdot 10^{-2}$	$3.8 \cdot 10^{-2}$	$4.4 \cdot 10^{-2}$		$-2.9 \cdot 10^{-4}$	$-2.9 \cdot 10^{-4}$	$-2.7 \cdot 10^{-4}$	$-2.9 \cdot 10^{-4}$	$-3.6 \cdot 10^{-4}$	$-4.3 \cdot 10^{-4}$
Nutrification (NP)	[kg PO4-eqv.]	$6.8 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$	$6.6 \cdot 10^{-3}$	$7.2 \cdot 10^{-3}$	$8.1 \cdot 10^{-3}$	$9.2 \cdot 10^{-3}$		$-5.3 \cdot 10^{-6}$	$-3.3 \cdot 10^{-7}$	$-8.6 \cdot 10^{-7}$	$-4.6 \cdot 10^{-6}$	$-1.8 \cdot 10^{-5}$	$-3.3 \cdot 10^{-5}$
Photochemical oxid. formation (POCP)	[kg ethene eqv.]	$3.5 \cdot 10^{-3}$	$3.6 \cdot 10^{-3}$	$3.2 \cdot 10^{-3}$	$3.5 \cdot 10^{-3}$	$3.9 \cdot 10^{-3}$	$4.3 \cdot 10^{-3}$		$-1.7 \cdot 10^{-4}$	$-1.9 \cdot 10^{-4}$	$-1.7 \cdot 10^{-4}$	$-1.8 \cdot 10^{-4}$	$-1.9 \cdot 10^{-4}$	$-2.0 \cdot 10^{-4}$

* Negative figures have a positive impact

Short version

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Environmental Product Declaration

Comparisons of this product with other floor coverings based on this EPD information are permissible only if the EPD are calculated applying common product category rules (PCR) and if the product's functionality is the same.

The LCA model used for this EPD is based on the IBU PCR for floor coverings, defining typical conventions e.g. the pre-set parameters, system boundaries or allocation and cut-off rules. The PCR are based on ISO 14025 and ISO 14040 / 44, and on the conventions developed in a consensus process by manufacturer and LCA experts. The PCR was reviewed in 2008 by the independent advisory board of IBU. Verified application of the PCR minimizes the variance of results, which are normal for any assessments based on measurements.

The results are based on the life cycle assessment for textile floor coverings and Desso data support

LCA conducted by **Gemeinschaft umweltfreundlicher Teppichboden** (GUT) e.V., Aachen,

in cooperation with:: **Textile and Flooring Institut GmbH**, Aachen,

critically reviewed by: **Prof. Dr. Walter Klöpffer**, Int. Journal of Life Cycle Assessment, LCA CONSULT & REVIEW, Frankfurt a.M.,
Dipl. Natw. ETH Roland Hischier, Head of unit LCA, EMPA, St Gallen

Verifications and tests

In addition, the following tests are represented in the environmental declaration:

VOC emissions	GUT product testing criteria based on AgBB scheme for the evaluation of emissions from building products
Tests for contaminants	GUT product testing criteria

0 Product definition

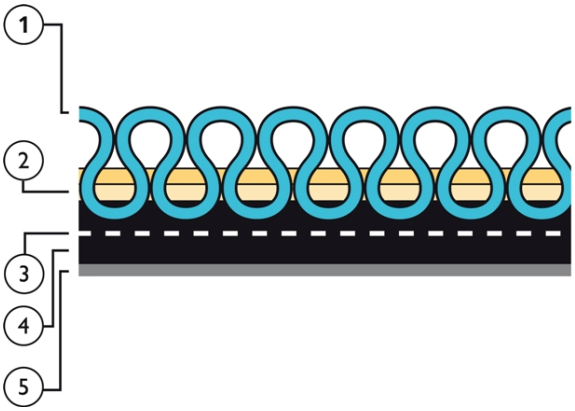
0.1 Product classification and description

Carpet tiles, tufted with 100% polyamide 6 yarns, solution dyed or continuous piece dyed, with PES/PA primary backing and modified bitumen secondary backing, covered by a PP non-woven fleece

The production site for tufting is placed in Dendermonde, Belgium. The semi-finished product is transported to the production site in Waalwijk, the Netherlands, where the backing is applied and tiles are cut.

The environmental product declaration covers a group of textile floor coverings having the following features

Type of manufacture:	Tufted
Pile fibre composition:	100% Polyamide 6 (PA6) yarns
Dye method:	Solution dyed (SD) or continuous piece dyed (CPD)
Primary backing:	Polyester/Polyamide (PES/PA) with latex pre-coat
Secondary backing:	Modified bitumen with glass reinforcement covered by a polypropylene (PP) non-woven fleece



Graph 1: Construction of a tufted carpet with modified bitumen backing

The primary backing (2) with the latex precoat provides fibre (1) and tuft anchorage, rigidity and stability, the glass reinforcement (3) further improves dimensional stability and the bitumen backing (4) adds weight and improves lay flat performance. The non-woven fleece (5) covers the entire backing.

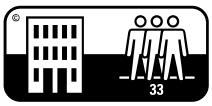
Subject to effective pile weight the product is divided into a specific comfort class, LC1 to LC5, as defined by EN1307 (table 1). This is displayed in the FCSS symbols on the PRODIS label.

Table 3: **Luxury classes and symbols**

Luxury class	Unit	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Total pile weight	g/m²	570	650	550	625	730	850
Effective pile weight	g/m²	290	345	360	400	470	545
Luxury rating		LC1	LC1	LC2	LC1	LC2	LC2
FCSS symbol							

Above mentioned products represent a broader range of commercial products, as stated in chapter 8.1.

0.2 Range of application



Class 33 – commercial heavy use
for all covered products in this EPD

The declaration of use class and luxury class as well as suitability for additional uses is indicated on the PRODIS label with FCSS symbols. It may be checked online via www.pro-dis.info by using the PRODIS license number (see chapter 0.4).

0.3 Product standard/ Approval

The following standards apply to the present product group:

DIN EN 1307 - Textile floor coverings – Classification of pile carpets
DIN EN 685 - Resilient, textile and laminate floor coverings - classification
DIN EN 14041 - Resilient, textile and laminate floor coverings - Essential characteristics
DIN EN 13501-1 - Classification of building products and building types according to their reaction to fire

The products are approved according to the European technical approval.

CE marking: 0493-CPD-0002

0.4 Accreditation

Desso PA6 carpet tile products have been awarded a GUT/PRODIS test label for environment-friendly products.

PRODIS license number:		
	Tempra	DAAE47D4
	AirMaster®	F98FC28D
	Stratos	D28E3E42
	Libra Lines	3A84F605
	Scape	E33C48FB
	Mila	2DA8D7F3

For other commercial products covered see chapter 8.1.

Within the framework of this product testing system, annual checks are done by independent test institutes.

Table 4: **Additional accreditations**

	GUT	CRI	BRE	GUI	C2C
Tempra	X	X	X	X	X
AirMaster®	X	X	X	X	X
Stratos	X	X	X	X	X
Libra Lines	X	X	X	X	X
Scape	X	X	X	X	X
Mila	X	X	X	X	X

The **BRE** (Building Research Establishment, UK) Environmental profile is a British green label based on LCA calculations conform ISO 21930.

The **CRI** (Carpet and Rug Institute, US) introduced Green Label Plus to identify carpets and adhesives that are tested by an independent, certified laboratory and meet stringent criteria for low chemical emissions.

GUI (Gesellschaft für Umwelt- und Innenraumanalytik, Gemany) is specialised in the measurement and analysis of indoor air quality (fine dust, chemical emissions, VOC's, bacteria, allergens et cetera) and the influence of (interior) products on the indoor air quality. Tests and measurements are run in both laboratory simulations and on-site locations.

Cradle to Cradle® (C2C) certification requires products of a specified quality focusing on a healthy environment. As part of Desso's partnership with the Environmental Protection Encouragement Agency (EPEA) the company has committed itself to a rigorous material assessment programme, which forms part of its overall implementation plan.

To assist in (re)designing Desso products, the Cradle to Cradle® Design Protocol is applied to assess materials used in Desso's products and production processes. Content materials are evaluated according to their characteristics for the desired application and their potential impacts throughout the Life Cycle of the product (recycling, composting, release into the wastewater, etc). They are then allocated to one of four categories (ABC-X categorisation) based on specified human health and environmental relevance criteria. The assessed product material composition is optimised by selecting appropriate replacements if available. For more information please refer to: www.epea.com

Desso's factories are certified under the ISO 9001 Quality Management System and ISO 14001 Environmental Management System

0.5 Delivery status

Table 5: **Characteristics of Desso PA 6 carpet tiles**

Features		**Tempra**	**Air Master®**	**Stratos**	**Libra Lines**	**Scape**	**Mila**
Type of manufacture		Tufted					
Pile fiber composition		100% Polyamide 6 (PA6)					
Primary backing		Polyester-Polyamide fleece, with latex pre-coat					
Secondary backing		Modified bitumen, with glass reinforcement and Polypropylene non-woven fleece					
Dye method		Continuous piece dyed	Solution dyed	Solution dyed	Solution dyed	Solution dyed	Solution dyed
Total pile weight	g/m²	570	650	550	625	730	850
Effective pile weight	g/m²	290	345	360	400	470	545
Total weight	g/m²	4013	4350	4032	4216	4247	4306
Additional features according to /EN 1307/, /EN 14041/		Additional characteristics and suitable uses of the product are declared through marking with an additional symbol according to /EN 685/ and are registered in the respective PRODIS licence.					

1 Material content

1.1 Material content

Table 6 lists the raw materials contained in the textile floor covering on delivery as well as their percentage shares in the weight.

Table 6: **Material contents**

Construction layer	Material	Share in weight [%]						Availability	Origin
		Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila		
Pile layer and Dead Pile*	PA 6	14.2	14.9	13.6	14.8	17.2	19.7	limited	Europe
Primary backing	PES/PA6	2.7	2.3	2.5	2.4	2.4	2.6	limited	Europe
Precoat	Limestone	19.2	23.6	20.0	21.8	19.8	17.9	ample	Europe
	SBR Latex							limited	Europe
Bitumen finish	Limestone	62.0	57.5	62.0	59.3	58.9	58.1	ample	Europe
	Bitumen							limited	Europe
Glass-fibre fleece	Glass fibres	0.7	0.7	0.7	0.7	0.7	0.7	ample	Europe
Cover fleece	PP	1.1	1.0	1.1	1.0	1.0	1.0	limited	Europe

* Designation for the share of yarn below the carrier surface.

1.2 Production of main materials

Polyamide 6 (PA6)

Polyamide 6 is a thermoplastic material that is formed from caprolactam through ring-opening polymerisation.

Polyester (PES)

Polyesters are polymers containing the ester functional group in their main chain. Above all, the term is used for the large family of plastic materials; most commonly this refers to the much used polyethylene terephthalate (PET).

Styrene Butadiene Rubber (SBR-Latex)

SBR latex is made through emulsion polymerisation from the monomers styrene and butadiene.

Limestone (CaCO3)

Limestone is a sedimentary rock that consists largely of calcium carbonate. The material is pulverized to be used as filler.

Bitumen

Bitumen is a visco-elastic material, consisting essentially of hydrocarbons and their derivatives. It is obtained by refinery processes from petroleum.

Glass-fleece

Glass-fleece is a non-woven mat made of long, thin glass fibres. The glass fibres are manufactured by drawing melted glass into thin threads.

Polypropylene (PP)

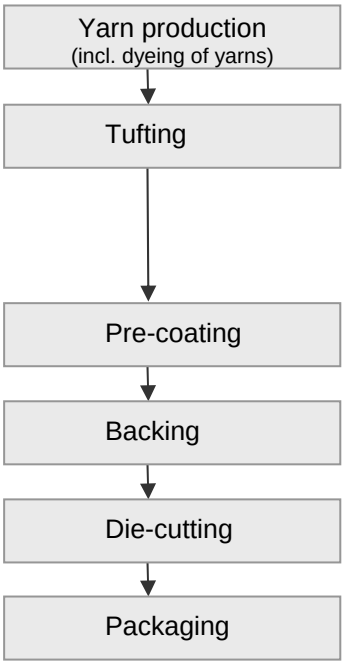
PP is a thermoplastic plastic material that is formed by means of catalysts through polymerisation of the monomer propene.

2 Product manufacture

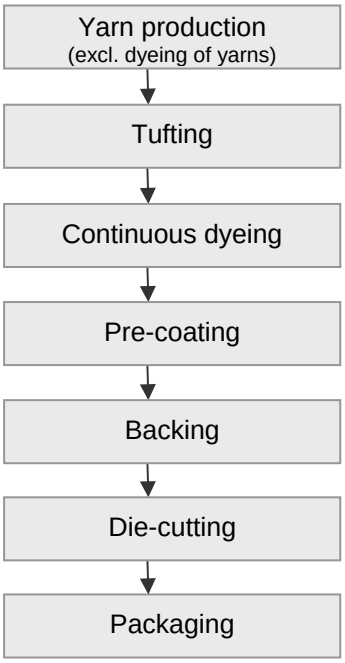
2.1 Production process

The production stages are shown in the following flow diagrams:

Production with solution dyed yarn:



Production with raw white yarn:



Graph 2: Production stages

Description of the production steps:

Tufting:
Pile threads are machine-sewn into the carrier material across the entire breadth of the product by means of a multitude of needles arranged next to each other. The resulting loops will appear on the later surface either as loops, or they can be cut open during the process and appear as cut pile.

Dyeing:
Colouring is done by means of aqueous or non-aqueous processes. In case of continuous piece dyeing, the raw product is impregnated with dyestuff solutions, pastes or foams, and the dye liquor is pressed into the fabric through a squeeze roll. With solution dyed yarns (non-aqueous) a colourant is added to the spinning mass, these substances then combining into a homogeneous mass.

Pre-coating
On the back of the tufted raw product, the SBR latex pre-coat is applied in order to anchor the bottom loop (filaments and tufts) of the pile yarn in the PES carrier layer.

Backing
The backing is applied to the pre-coated semi-finished product. This backing is produced by impregnating a glass-fleece with a hot bitumen compound and covering it with a fleece made of Polypropylene (PP).

Die-cutting and packaging:
The tufted and backed carpet is cut into tiles using a die-cutting machine. Quality inspection is then carried out and the carpet tiles are subsequently packed into boxes for storage and transport to the installation site.

2.2 Health, safety and environmental aspects during production

For years, Desso has continued to improve health, safety and environmental aspects of its operations.

Energy and greenhouse gases

Desso uses 100% renewable electricity (hydropower) at its production locations in Waalwijk, the Netherlands and in Dendermonde, Belgium. CO_2 emissions have been reduced by 59% between 2008 and 2009 at Desso's production facilities in Waalwijk, the Netherlands and in Dendermonde, Belgium.

Clean water

At Desso's main production facility in Dendermonde wastewater is purified by biological and ozone treatment. Ozonised waste water is reused in production saving 12% drinking water.

After biological and ozone treatment, waste water can be released into the river. Water is returned to river beyond European environmental regulations.

Supply-chain management

In order to stimulate upstream sustainability and ensure products have a beneficial impact throughout their entire life-cycle, suppliers are asked to report all ingredients down to 100 ppm and sign a declaration, confirming their compliance with:

- Desso’s Cradle-to-Cradle® and sustainability policy
- Desso’s Product Stewardship Directive
- Global Sullivan principles
- REACH requirements
- GUT-requirements

The procedure "acceptance of raw materials & auxiliaries" and the supllier declaration is part of Desso's ISO 14001 certified Environmental Management System.

Right now 54 suppliers have signed Desso's supplier declaration. For the materials that are listed in this EPD (see in table 6) all suppliers have signed the declaration and all ingredients have been reported, exept for bitumen, which is going to be phased-out at Desso.

Safety

Desso continuously invests in its facilities to ensure the health and safety of the workforce.

At Desso's production site in Waalwijk, the Netherlands there have been no lost time accidents for more than three years.

In Dendermonde, Belgium lost-time accidents have been reduced by 50% between 2008 and 2009, as a result of Awareness Training provided to all employees.

3 Delivery and installation

3.1 Delivery

Desso carpets are transported from the production plant to the European end user by lorry. For the purpose of the life cycle assessment calculation, a 14-20 ton lorry with 85% average utilisation of its payload and an average transport route of 700 km have been considered for delivery.

All of Desso's suppliers use modern vehicles that comply with emission standards set out by the EU’s Kyoto agreement.

Desso carpet tiles are easily transported from A to B, without the inconvenience of large rolls being manoeuvred through door openings and up stairways. Carpet tiles are packed in boxes of 20 with a total weight not exceeding 23 kg (in line with health and safety regulations). Boxes with carpet tiles can be palletized for easy transport and storage.

3.2 Installation

Generally, a textile carpet tile floor covering will be installed in two different ways:

Loose laying

In case of loose laying, the carpet tiles are laid in the room without adhesion, onto a ready-for-installation surface and fixed by means of a double-faced adhesive tape.

Fixing with tackifier

To fix the carpet, a tackifier with limited adhesive power across the entire surface is used. This enables removal of the floor covering without destruction of the sub floor. Fixing agents are aqueous plastic dispersions that are uniformly applied to the sub floor, either by means of a foam roller or sprayed. Then carpet tiles are installed for the entire surface. The fixing agent required per m² may be assumed to be 100g.

3.3 Health, safety and environmental aspects during installation

The textile floor covering is laid by means of very low emitting auxiliary materials (adhesives, fixing agents) that meet the requirements of emission class /EC1/. Furthermore, Desso is working closely with its adhesive suppliers to develop products that fit in the Cradle to Cradle® philosophy.

3.4 Waste

Due to their modular format, carpet tiles offer the advantage of ease and flexibility of installation. This minimizes waste from installation.
Possible cutting scrap can be taken back and used as secondary fuel within the cement industry

3.5 Packaging

For transport, carpet tiles are packaged in cardboard cartons made from 100% post-consumer recycled content.

On a project basis tiles can be palletized to avoid the use of boxes, thereby significantly reducing packaging.

4 Use stage

4.1 Use

Subject to the marking on the PRODIS label, Desso carpet tiles are intended for commercial areas. However, they may be used for residential purposes as well. Additional suitability is also shown on the PRODIS label by means of an FCSS (Floor Covering Standard Symbols) symbol.

Desso carpet tiles have a minimum service life of 10 years, although fashion-related and aesthetic aspects often mean that carpet is replaced earlier. Technical wear resistance may last much longer, if carpets tiles are installed, used and maintained in line with Desso's recommendation. Service life depends on the actual use conditions. Life cycle impact can be calculated by using the formular in chapter 7.9.6

4.1.1 Cleaning and maintenance

The classical cleaning appliance for the daily and regular care of the textile floor covering is the vacuum cleaner. To achieve optimal cleaning, Desso recommends the use of heavy duty upright vacuums with a brushing action, both for products covered in this EPD and in general. In the life cycle assessment, the average cleaning frequency is assumed to be four times a week in commercial areas. These values are mean values based on experience; the actual cleaning frequency is heavily dependent on the intensity of use and the degree of soiling. Electrical energy is required to operate the vacuum cleaner. Incidental stain removal is not regarded within the life cycle assessment.

For periodic maintenance the tips of the carpet are cleaned by pad-, spray or powder cleaning to reduce the need for major maintenance.

For major maintenance, a wet cleaning process is employed. Here, dirt is rinsed out of the surface pile, as a rule by means of a spray extraction cleaner. A cleaning frequency of 3 times in 2 years in commercial areas is recommended and taken into account in the life cycle assessment, the frequency depending on individual factors. The method requires the use of water and a cleaning agent and electrical energy is

needed to operate the spray extraction cleaner.

For more information please refer to Desso's Cleaning and Maintenance guide: http://www.desso.com/Desso/BusinessCarpets/bc_en/Manuals_Brochues.html

4.1.2 Prevention of structural damage

In order to avoid excessive wear and changes in appearance during the use stage, usage should not exceed the permitted levels as indicated in the use class of each individual product. Additional suitability indicated by an extra symbol according to /EN 685/ may enlarge the range of application.

The installation of entrance barrier products, such as Desso Protect and Entry carpet tiles, keeps dirt and moist out of a building, enabling the preservation of aesthetics and quality of the carpet in the rest of the building.

4.2 Health aspects during usage

Relevant emission sources during the use stage may include the textile floor covering itself as well as the adhesives.

The emissions of the textile floor covering on delivery meet the requirements of the GUT test criteria for VOC emissions (Table 7) and contaminants (version 2011). For further information see www.gut-ev.org.

On this aspect test criteria for the CRI Green Label Plus certification are met.

Table 7: **Limit values for volatile organic compounds**

Component	3 days cut off	Limit value after 28 days	Unit
TVOC (C_6 to C_{16})	250	100	µg/m³
SVOC (C_{16} to C_{23})	30	30	µg/m³
VOC without NIK	100	50	µg/m³
R value	< 1,0	< 1,0	µg/m³
Formaldehyde	10	4	µg/m³
Carcinogenic substances (EU list classes 1 and 2)	not detectable		-

Adhesives at least have to meet the requirements of emission class /EC1/.

Another important aspect in the indoor air quality is the level of fine dust concentration. The burden from fine dust is drastically reduced when using carpet, as opposed to other flooring solutions*.

All products covered within this EPD have been tested by Gesellschaft fur Umwelt- und Innenraumanalytik, Gemany (GUI)

GUI is specialised in the measurement and analysis of indoor air quality (fine dust, chemical emissions, VOC's, bacteria, allergens et cetera) and the influence of (interior) products on the indoor air quality. Tests and measurements are run in both laboratory simulations and on-site locations.

The products covered in this EPD have proven to effectively reduce fine dust in indoor air**. DESSO AirMaster®'s patented*** technology has been specially developed to capture and retain hazardous fine dust and further improve indoor air quality. For more information, please refer to http://www.desso.com/BC_Functionality-Indoor_Air_Quality_EN.html

* Source: Study performed by Deutscher Allergie- und Asthmabund e.V. in 2005.

* GUI Basic logo is awarded when fine dust retention efficiency is >20% (PM10). Desso AirMaster® has been awarded the GUI Gold as it has fine dust retention efficiency > 80% (PM10)

*** Patent pending: NL 2002808.

5 Singular effects

5.1 Fire The fire protection class is shown on the PRODIS label.

5.2 Water In the unlikely event that major water quantities are present on the carpet over a prolonged period of time, then this may cause damage to the carpet.

5.3 Mechanical damage Product is intended for commercial applications with heavy wear. Excessive wear of the textile floor covering during its service life need not be expected if it is employed and properly installed, used, maintained and cleaned in compliance with its declared suitability (PRODIS). Product should be installed and maintained according to Desso guidelines.

6 End-of-life stage

According to Class 20 01 11 of the ”European Waste Catalogue“ (EWC) the textile floor covering to be disposed of may be classified as “municipal solid waste – textiles” (non-hazardous waste). Accordingly, disposal is carried out in compliance with local waste disposal systems.

6.1 Recycling or re-use As part of the Cradle to Cradle® policy Desso has introduced a Take Back™ program for carpet waste. Desso offers international collection of all types of carpet waste, irrespective of brand and type, with the exception of carpets containing PVC. As part of Desso's Take Back™ program, more than 1000 tons of carpet material have been collected and processed since 2009.
Traditionally, collected carpet is processed by a waste management company and used as secondary fuel in the cement industry.
From april 2010 Desso is taking additonal efforts with its Refinity® plant: a technique to seperate the yarn from the backing and re-using both material streams separately. 553 t post-consumer carpet has been processed at Refinity since then.

6.2 Disposal Carpet waste can be disposed on landfills, recovered in waste incineration plants or used as secondary fuel e.g. in cement kilns. Energetic recovery is the more sustainable method compared to landfill. In Germany disposal on landfill has no longer been possible since 2005.

7 Life cycle assessment

7.1 General The EPD is based on the life cycle assessment ‘textile floor coverings‘, conducted by GUT.

The respective results for the product manufacture, the delivery/installation, the use stage, and the end-of-life stage are shown separately, likewise the credits from energy and substantial recovery of waste.

- The assessment of the **product manufacture** takes into consideration the indicated dyeing methods 'solution dyed' and 'continuous piece dyed'.
  Production waste is recovered in the cement industry.
  Recovery of carpet waste in the cement industry results in energy and substantial credits and causes no additional impact. Carpet waste substitutes the input of energy sources (lignite, mineral coal and petrol coke) and the input of chalk.
  Desso uses electricity from 100% renewable resources (hydro energy).
  For the electrical energy used in external processes, background data from /GaBi 4/ for the EU 15 power mix are used.

- For the stages **delivery/installation** standardised conditions and average transport distances within Europe are assumed (see chapter 3) and used for calculation. Packaging waste is recovered in a municipal waste incineration plant. The assessment of the installation considers loose laying and fixing by tackifier.
- For the **use** stage, standardised conditions are assumed for cleaning and maintenance (see chapter 4).
- For the **end-of-life** stage, the calculation considers 30% recovery in municipal waste incineration and 70% recovery in the cement industry as clinker and energy. The distance to waste incineration plant is assumed to be 30 km, to the cement plant it is assumed to be 200 km.

The basic data used meet the requirements according to chapter 7.6.

7.2 Functional unit

The declaration refers to 1 m² of tufted textile floor covering of a specific use class.

For the assessment of the use stage, the period of one year is taken into consideration. The values for deviating periods of use may be calculated by means of multiplication with the relevant factor.

7.3 Cut-off criteria

The limit of detail amounts to one per cent relative to the sum of the input streams and the energy input for the respective process. Substances used in smaller quantities but have a crucial function (e.g. the dye) are assessed as well. The sum of all neglected inputs in one process amounts to not more than 5% of the energy input and input streams.

7.4 Allocation

/ISO 14040/ defines the allocation as " partitioning the input or output flow of a unit process to the product system under study ". In the present life cycle assessment, no relevant allocations (i.e. partitionings of environmental burdens of a process to several products) had to be made for the product manufacture, delivery, installation and use. Re-use entails an energy credit note due to the incineration of the textile waste and additional a credit note for avoided raw material (chalk) due to re-use in the cement industry.

7.5 Background data

The background data refer to

/GaBi 4/, Database for the Preparation of life cycle assessments, service pack 14 and /Ecoinvent/, Data Version 2.0.

7.6 Data quality

For calculation purposes Desso provided original data for product specifications and processes for the period 2008-2009. Additionally generic data were used.

The GUT-LCA uses data provided by the GUT member firms and generic data. For the inventories used, for the general processes and for all production steps, the data used in the inventory analysis were collected indicating their origin, the kind of data recording, the time-related, geographical and technological reference.
As background data, European values from the /GaBi 4/ database were referred to.
In as much as the framework of the assessment and the objective of the assessment are concerned, the data sets are complete and reflect representative values of the European carpet industry for the life-cycle-assessment stages production, delivery/installation, usage and disposal.

The consistency and the traceability of the GUT-LCA data were reviewed in the critical review of the LCA study by Prof. Dr. Walter Klöpffer, Frankfurt a.M., and Dipl. Natw. Roland Hischier, St Gallen.

7.7 System boundaries

The life cycle assessment covers the entire life cycle of Desso carpet tiles from cradle to the grave.

The **production stage** includes the extraction and manufacture of all raw materials used, their transport to the production facility, the entire production process,

transport of production waste to the recovery plant and the packaging, inclusive of the packing material of the carpet tiles. Recovery of production waste in the cement industry results in credits that are shown in a separate table.

The **delivery/installation** stage includes the transport of the packed carpet to the place of installation, its installation, inclusive of the provision of the fixing and adhesive agents, their production and transport to the place of installation. Transport of the packaging waste to the municipal incineration plant and impact of the recovery process are included. Credits from incineration of packaging waste are shown in a separate table.

The **use stage** covers the cleaning and maintenance of the carpet during the period of one year including the extraction of the raw materials, the cleaning agents, their production and transport. The treatment of the waste water occurring during spray extraction is taken into consideration.

For the **end-of-life stage**, the transport of the de-installed carpet to the reprocessing partner/location as well as the material and energy input of the waste incineration plant for the thermal use and all emissions are considered. The carpet waste substitutes the input of energy sources (lignite, mineral coal and petrol coke) and the input of chalk.
Energy credits from carpet waste recovery are shown in a separate table.

In all life cycle stages, the respective disposal processes up to final deposition, with the exception of the deposition of nuclear waste, are modelled.

7.8 Note on use stage

The actual service life of a textile floor covering depends on various impact factors such as the allocation of the area of application to the use class, the maintenance and the intensity of usage.
The comparability of textile floor coverings requires, among other things, uniform conditions of usage. For the life cycle assessment the indicators for defined usage scenarios were calculated as annual averages.

7.9 Result of the life cycle assessment (LCA)

The results of the life cycle assessment are shown in Tables 8 to 14 for the product manufacture, the delivery/installation, the use stage and the end-of-life stage.

7.9.1 Product manufacture

Table 8: **Environmental impact from product manufacture (Part 1)**
- without credits from recovery of production waste -

Evaluation value	Unit per m²	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Primary energy non-renewable	[MJ]	177.7	180.7	160.1	173.2	190.5	213.3
Primary energy renewable	[MJ]	8.6	4.6	4.3	4.5	4.9	5.3
Abiotic depletion (ADP)	[kg Sb-eqv.]	$7.8 \cdot 10^{-2}$	$7.9 \cdot 10^{-2}$	$7.0 \cdot 10^{-2}$	$7.6 \cdot 10^{-2}$	$8.3 \cdot 10^{-2}$	$9.3 \cdot 10^{-2}$
Global warming potential (GWP 100)	[kg CO_2-eqv.]	9.93	10.16	8.81	9.71	11.01	12.74
Ozone depletion potential (ODP)	[kg R11-eqv.]	$5.9 \cdot 10^{-7}$	$6.4 \cdot 10^{-7}$	$6.0 \cdot 10^{-7}$	$6.2 \cdot 10^{-7}$	$6.7 \cdot 10^{-7}$	$7.2 \cdot 10^{-7}$
Acidification potential (AP)	[kg SO_2-eqv.]	$3.3 \cdot 10^{-2}$	$3.6 \cdot 10^{-2}$	$3.1 \cdot 10^{-2}$	$3.4 \cdot 10^{-2}$	$3.9 \cdot 10^{-2}$	$4.5 \cdot 10^{-2}$
Nutrification (NP)	[kg PO_4-eqv.]	$6.9 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$	$6.6 \cdot 10^{-3}$	$7.2 \cdot 10^{-3}$	$8.1 \cdot 10^{-3}$	$9.3 \cdot 10^{-3}$
Photochemical oxid. formation (POCP)	[kg ethene eqv]	$3.5 \cdot 10^{-3}$	$3.7 \cdot 10^{-3}$	$3.2 \cdot 10^{-3}$	$3.5 \cdot 10^{-3}$	$3.9 \cdot 10^{-3}$	$4.4 \cdot 10^{-3}$

Tempra differs from the other products as its manufacturing process includes an additional step of continuous piece dyeing. Generally there is a linear effect between (total) pile weight and the impact on energy use and other aspects.

Table 9: **Environmental impact from recovery of production waste**
- only credits, indicated in negative values -

Evaluation value	Unit per m²	reco-very	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Primary energy non-renewable	[MJ]	e	-3.74	-5.43	-4.34	-4.46	-6.41	-8.42
		s	$-7.9\cdot10^{-2}$	$-9.5\cdot10^{-2}$	$-8.8\cdot10^{-2}$	$-7.9\cdot10^{-2}$	-0.11	-0.11
Primary energy renewable	[MJ]	e	$-9.0\cdot10^{-3}$	$-1.9\cdot10^{-2}$	$-1.7\cdot10^{-2}$	$-1.8\cdot10^{-2}$	$-2.1\cdot10^{-2}$	$-2.5\cdot10^{-2}$
		s	$-1.0\cdot10^{-3}$	$-1.3\cdot10^{-3}$	$-1.1\cdot10^{-3}$	$-1.0\cdot10^{-3}$	$-1.4\cdot10^{-3}$	$-1.4\cdot10^{-3}$
Abiotic depletion (ADP)	[kg Sb-eqv.]	e	$-1.8\cdot10^{-3}$	$-2.6\cdot10^{-3}$	$-2.0\cdot10^{-3}$	$-2.1\cdot10^{-3}$	$-3.0\cdot10^{-3}$	$-4.0\cdot10^{-3}$
		s	$-3.0\cdot10^{-5}$	$-3.6\cdot10^{-5}$	$-3.3\cdot10^{-5}$	$-3.0\cdot10^{-5}$	$-4.1\cdot10^{-5}$	$-4.3\cdot10^{-5}$
Global warming pot. (GWP 100)	[kg CO_2-eqv.]	e	$-3.6\cdot10^{-2}$	$-7.0\cdot10^{-2}$	$-5.7\cdot10^{-2}$	$-5.7\cdot10^{-2}$	$-8.0\cdot10^{-2}$	$-9.8\cdot10^{-2}$
		s	$-4.9\cdot10^{-3}$	$-5.9\cdot10^{-3}$	$-5.4\cdot10^{-3}$	$-5.4\cdot10^{-3}$	$-6.6\cdot10^{-3}$	$-6.9\cdot10^{-3}$
Ozone depletion pot. (ODP)	[kg R11-eqv.]	e	$-7.4\cdot10^{-9}$	$-1.1\cdot10^{-8}$	$-8.9\cdot10^{-9}$	$-8.9\cdot10^{-9}$	$-1.3\cdot10^{-8}$	$-1.7\cdot10^{-8}$
		s	$-4.5\cdot10^{-10}$	$-5.5\cdot10^{-10}$	$-5.0\cdot10^{-10}$	$-5.0\cdot10^{-10}$	$-6.2\cdot10^{-10}$	$-6.4\cdot10^{-10}$
Acidification potential (AP)	[kg SO_2-eqv.]	e	$-1.7\cdot10^{-4}$	$-2.7\cdot10^{-4}$	$-2.2\cdot10^{-4}$	$-2.2\cdot10^{-4}$	$-3.2\cdot10^{-4}$	$-4.1\cdot10^{-4}$
		s	$-2.5\cdot10^{-5}$	$-3.0\cdot10^{-5}$	$-2.7\cdot10^{-5}$	$-2.7\cdot10^{-5}$	$-3.4\cdot10^{-5}$	$-3.5\cdot10^{-5}$
Nutrification (NP)	[kg PO4-eqv.]	e	$-3.3\cdot10^{-5}$	$-4.8\cdot10^{-5}$	$-3.8\cdot10^{-5}$	$-3.8\cdot10^{-5}$	$-5.7\cdot10^{-5}$	$-7.4\cdot10^{-5}$
		s	$-2.5\cdot10^{-6}$	$-3.0\cdot10^{-6}$	$-2.7\cdot10^{-6}$	$-2.7\cdot10^{-6}$	$-3.3\cdot10^{-6}$	$-3.5\cdot10^{-6}$
Photochemical oxid. formation (POCP)	[kg ethene eqv]	e	$-2.0\cdot10^{-5}$	$-3.1\cdot10^{-5}$	$-2.5\cdot10^{-5}$	$-2.5\cdot10^{-5}$	$-3.6\cdot10^{-5}$	$-4.7\cdot10^{-5}$
		s	$-2.0\cdot10^{-6}$	$-2.4\cdot10^{-6}$	$-2.2\cdot10^{-6}$	$-2.2\cdot10^{-6}$	$-2.7\cdot10^{-6}$	$-2.8\cdot10^{-6}$

Table 9 shows the environmental credits, resulting from the energy recovery and chalk reuse in cement kilns.
Organic matter is energetically (e) utilized, inorganic matter (mainly chalk) is re-used as secondary material (s).
To get a complete view on the LC, the credits should be taken into consideration.

7.9.2 Delivery/ installation

Table 10: **Environmental impact from delivery/installation (Part 2)**
- without credits from recovery of packaging waste -

Evaluation value	Unit per m²	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Primary energy non-renewable	[MJ]	4.77	5.03	4.79	4.93	5.00	5.00
Primary energy renewable	[MJ]	$7.7\cdot10^{-3}$	$8.1\cdot10^{-3}$	$7.7\cdot10^{-3}$	$7.9\cdot10^{-3}$	$8.0\cdot10^{-3}$	$8.0\cdot10^{-3}$
Abiotic depletion (ADP)	[kg Sb-eqv.]	$2.2\cdot10^{-3}$	$2.3\cdot10^{-3}$	$2.2\cdot10^{-3}$	$2.3\cdot10^{-3}$	$2.3\cdot10^{-3}$	$2.3\cdot10^{-3}$
Global warming potential (GWP 100)	[kg CO_2-eqv.]	0.48	0.49	0.48	0.49	0.49	0.49
Ozone depletion potential (ODP)	[kg R11-eqv.]	$9.2\cdot10^{-9}$	$9.3\cdot10^{-9}$	$9.2\cdot10^{-9}$	$9.2\cdot10^{-9}$	$9.3\cdot10^{-9}$	$9.3\cdot10^{-9}$
Acidification potential (AP)	[kg SO_2-eqv.]	$1.8\cdot10^{-3}$	$1.9\cdot10^{-3}$	$1.8\cdot10^{-3}$	$1.9\cdot10^{-3}$	$1.9\cdot10^{-3}$	$1.9\cdot10^{-3}$
Nutrification (NP)	[kg PO_4-eqv.]	$3.5\cdot10^{-4}$	$3.7\cdot10^{-4}$	$3.5\cdot10^{-4}$	$3.6\cdot10^{-4}$	$3.7\cdot10^{-4}$	$3.7\cdot10^{-4}$
Photochemical oxid. formation (POCP)	[kg ethene eqv]	$1.7\cdot10^{-4}$	$1.8\cdot10^{-4}$	$1.7\cdot10^{-4}$	$1.8\cdot10^{-4}$	$1.8\cdot10^{-4}$	$1.8\cdot10^{-4}$

Table 11: **Environmental impact from recovery of packaging waste - only credits, indicated in negative values -**							
Evaluation value	**Unit per m²**	**Tempra**	**Air Master®**	**Stratos**	**Libra Lines**	**Scape**	**Mila**
Primary energy non-renewable	[MJ]	-2.7					
Primary energy renewable	[MJ]	-0.22					
Abiotic depletion (ADP)	[kg Sb-eqv.]	$-6.8 \cdot 10^{-4}$					
Global warming potential (GWP 100)	[kg CO_2-eqv.]	-0.13					
Ozone depletion potential (ODP)	[kg R11-eqv.]	$-3.4 \cdot 10^{-8}$					
Acidification potential (AP)	[kg SO_2-eqv.]	$-5.8 \cdot 10^{-4}$					
Nutrification (NP)	[kg PO_4-eqv.]	$-3.0 \cdot 10^{-5}$					
Photochemical oxid. formation (POCP)	[kg ethene eqv]	$-3.5 \cdot 10^{-5}$					

Table 11 shows the environmental credits from energetic recovery of the packaging waste in the waste incineration plant.
To get a complete view, the credits should be taken into consideration.

7.9.3 Use stage

Table 12: **Environmental impact from the use stage per year (Part 2)**		
Evaluation value	**Unit per m²**	**Values independent of product**
Primary energy non-renewable	[MJ]	3.77
Primary energy renewable	[MJ]	0.25
Abiotic depletion (ADP)	[kg Sb-eqv.]	$1.1 \cdot 10^{-3}$
Global warming potential (GWP 100)	[kg CO_2-eqv.]	0.18
Ozone depletion potential (ODP)	[kg R11-eqv.]	$4.0 \cdot 10^{-8}$
Acidification potential (AP)	[kg SO_2-eqv.]	$7.7 \cdot 10^{-4}$
Nutrification (NP)	[kg PO_4-eqv.]	$9.2 \cdot 10^{-5}$
Photochemical oxid. formation (POCP)	[kg ethene eqv]	$6.2 \cdot 10^{-5}$

The results for this stage in the product life cycle only count for 1 year. To calculate the results for the entire useful life of a product they have to be multiplied by the assumed number of years (n) that the product will be used.

7.9.4 End-of-life stage

Table 13: **Environmental impact from the end-of-life stage (Part 3)**
- without credits from recovery of carpet waste -

Evaluation value	Unit per m²	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Primary energy non-renewable	[MJ]	3.28	3.56	3.30	3.45	3.47	3.52
Primary energy renewable	[MJ]	$3.3\cdot10^{-2}$	$3.6\cdot10^{-2}$	$3.3\cdot10^{-2}$	$3.5\cdot10^{-2}$	$3.5\cdot10^{-2}$	$3.6\cdot10^{-2}$
Abiotic depletion (ADP)	[kg Sb-eqv.]	$1.4\cdot10^{-3}$	$1.5\cdot10^{-3}$	$1.4\cdot10^{-3}$	$1.5\cdot10^{-3}$	$1.5\cdot10^{-3}$	$1.5\cdot10^{-3}$
Global warming pot. (GWP 100)	[kg CO_2-eqv.]	2.39	2.59	2.40	2.51	2.53	2.56
Ozone depletion pot.(ODP)	[kg R11-eqv.]	$1.1\cdot10^{-8}$	$1.1\cdot10^{-8}$	$1.1\cdot10^{-8}$	$1.1\cdot10^{-8}$	$1.1\cdot10^{-8}$	$1.1\cdot10^{-8}$
Acidification potential (AP)	[kg SO_2-eqv.]	$2.9\cdot10^{-3}$	$3.1\cdot10^{-3}$	$2.9\cdot10^{-3}$	$3.0\cdot10^{-3}$	$3.0\cdot10^{-3}$	$3.1\cdot10^{-3}$
Nutrification (NP)	[kg PO_4-eqv.]	$5.0\cdot10^{-4}$	$5.4\cdot10^{-4}$	$5.0\cdot10^{-4}$	$5.3\cdot10^{-4}$	$5.3\cdot10^{-4}$	$5.4\cdot10^{-4}$
Photochemical oxid.form.(POCP)	[kg ethene eqv]	$1.7\cdot10^{-4}$	$1.8\cdot10^{-4}$	$1.7\cdot10^{-4}$	$1.8\cdot10^{-4}$	$1.8\cdot10^{-4}$	$1.8\cdot10^{-4}$

70 % of the carpet waste was recovered in the cement industry, 30 % in the waste incineration plant. The values for environmental impact from the end-of-life-stage include transport to the recovery site and impact from the waste incineration plant. Recovery of carpet waste in the cement industry causes no additional impact.

Table14: **Environmental impact from recovery of carpet waste**
- only credits, indicated in negative values -

Evaluation value	Unit per m²	reco-very	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Primary energy non-renewable	[MJ]	e	-55.1	-59.7	-54.8	-57.9	-59.9	-62.6
		s	-1.36	-1.39	-1.36	-1.38	-1.37	-1.36
Primary energy renewable	[MJ]	e	-0.19	-0.21	-0.19	-0.20	-0.20	-0.21
		s	$-1.7\cdot10^{-2}$	$-1.9\cdot10^{-2}$	$-1.7\cdot10^{-2}$	$-1.9\cdot10^{-2}$	$-1.8\cdot10^{-2}$	$-1.7\cdot10^{-2}$
Abiotic depletion (ADP)	[kg Sb-eqv.]	e	$-2.6\cdot10^{-2}$	$-2.8\cdot10^{-2}$	$-2.6\cdot10^{-2}$	$-2.6\cdot10^{-2}$	$-2.8\cdot10^{-2}$	$-3.0\cdot10^{-2}$
		s	$-5.2\cdot10^{-4}$	$-5.3\cdot10^{-4}$	$-5.2\cdot10^{-4}$	$-5.2\cdot10^{-4}$	$-5.2\cdot10^{-4}$	$-5.2\cdot10^{-4}$
Global warming pot. (GWP 100)	[kg CO_2-eqv.]	e	-1.3	-1.4	-1.3	-1.3	-1.4	-1.5
		s	$-8.4\cdot10^{-2}$	$-8.6\cdot10^{-2}$	$-8.4\cdot10^{-2}$	$-8.4\cdot10^{-2}$	$-8.4\cdot10^{-2}$	$-8.4\cdot10^{-2}$
Ozone depletion pot. (ODP)	[kg R11-eqv.]	e	$-8.9\cdot10^{-8}$	$-9.7\cdot10^{-8}$	$-8.9\cdot10^{-8}$	$-8.9\cdot10^{-8}$	$-9.8\cdot10^{-8}$	$-1.0\cdot10^{-7}$
		s	$-7.8\cdot10^{-9}$	$-8.1\cdot10^{-9}$	$-7.8\cdot10^{-9}$	$-7.8\cdot10^{-9}$	$-7.8\cdot10^{-9}$	$-7.8\cdot10^{-9}$
Acidification potential (AP)	[kg SO_2-eqv.]	e	$-2.7\cdot10^{-3}$	$-3.0\cdot10^{-3}$	$-2.7\cdot10^{-3}$	$-2.7\cdot10^{-3}$	$-3.0\cdot10^{-3}$	$-3.1\cdot10^{-3}$
		s	$-4.2\cdot10^{-4}$	$-4.3\cdot10^{-4}$	$-4.3\cdot10^{-4}$	$-4.3\cdot10^{-4}$	$-4.3\cdot10^{-4}$	$-4.2\cdot10^{-4}$
Nutrification (NP)	[kg PO_4-eqv.]	e	$-4.6\cdot10^{-4}$	$-5.0\cdot10^{-4}$	$-4.6\cdot10^{-4}$	$-4.6\cdot10^{-4}$	$-5.1\cdot10^{-4}$	$-5.3\cdot10^{-4}$
		s	$-4.2\cdot10^{-5}$	$-4.3\cdot10^{-5}$	$-4.2\cdot10^{-5}$	$-4.2\cdot10^{-5}$	$-4.2\cdot10^{-5}$	$-4.2\cdot10^{-5}$
Photochemical oxid. formation (POCP)	[kg ethene eqv]	e	$-3.1\cdot10^{-4}$	$-3.4\cdot10^{-4}$	$-3.1\cdot10^{-4}$	$-3.1\cdot10^{-4}$	$-3.4\cdot10^{-4}$	$-3.5\cdot10^{-4}$
		s	$-3.4\cdot10^{-5}$	$-3.4\cdot10^{-5}$	$-3.4\cdot10^{-5}$	$-3.4\cdot10^{-5}$	$-3.4\cdot10^{-5}$	$-3.4\cdot10^{-5}$

Table 14 shows the environmental credits from recovery of the carpet waste. Recovery in the cement industry results in credits from energetic recovery (e) of organic matter and in credits from substantial recovery (s) of inorganic matter.
In incineration plants the carpet waste is only energetically recovered.
To get a complete view, the credits should be taken into consideration.

7.9.6 Entire life cycle

The values for impact during the entire life cycle may be calculated as follows:

$$\textbf{value}_{\textbf{total}} = \text{value}_{(\text{Tab. 8})} - \text{value}_{(\text{Tab. 9})} + \text{value}_{(\text{Tab. 10})} - \text{value}_{(\text{Tab. 11})} + \text{value}_{(\text{Tab. 12})} \cdot n + \text{value}_{(\text{Tab. 13})} - \text{value}_{(\text{Tab. 14})},$$

n representing the number of years of life considered

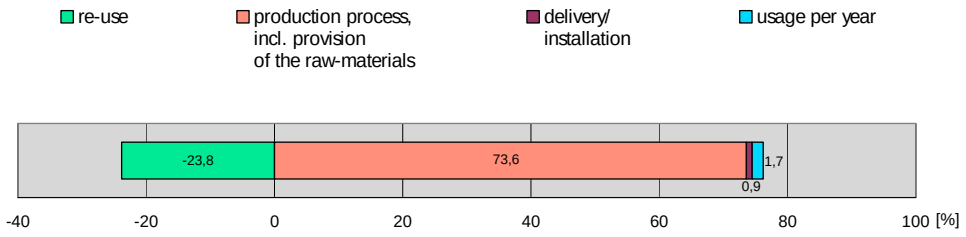
7.10 Life cycle inventory analysis (LCI)

The following chapters will describe in all detail the selected indicators of the life cycle analysis of 1 m² of textile floor covering for all life stages, taking into consideration a service life of 1 year.

7.10.1 Primary energy requirement

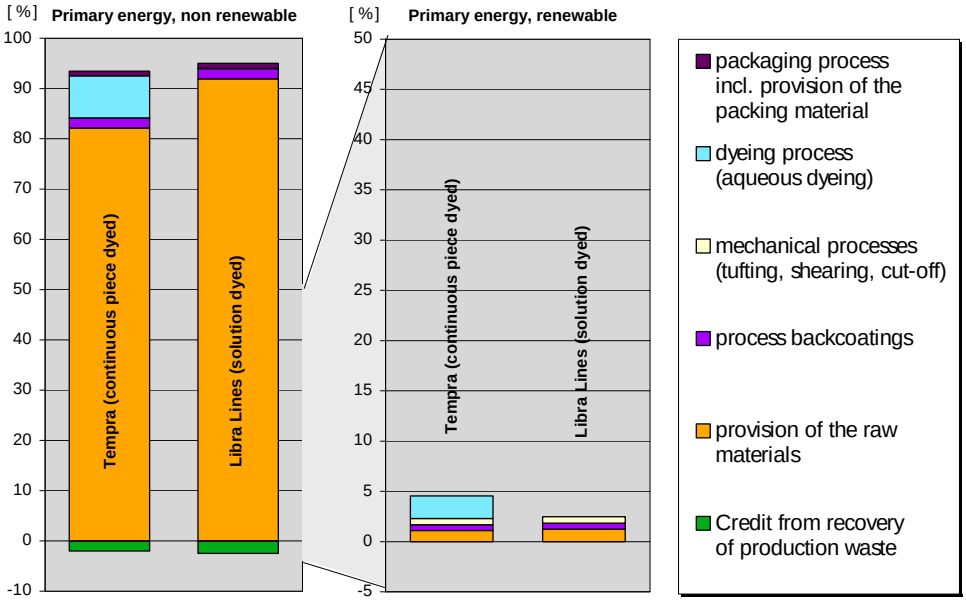
The primary energy here under consideration results from the energy input for all processes and from the energy that is bound in the raw materials as fossil resources (oil).

Graph 3 shows the relative contributions of the life cycle stages 'product manufacture' including the provision of the raw materials (85-95% of this stage), 'delivery/installation', 'usage per year' and 're-use' to the primary energy consumption (regenerative and non-regenerative).
The values include environmental impact and credit of each stage.



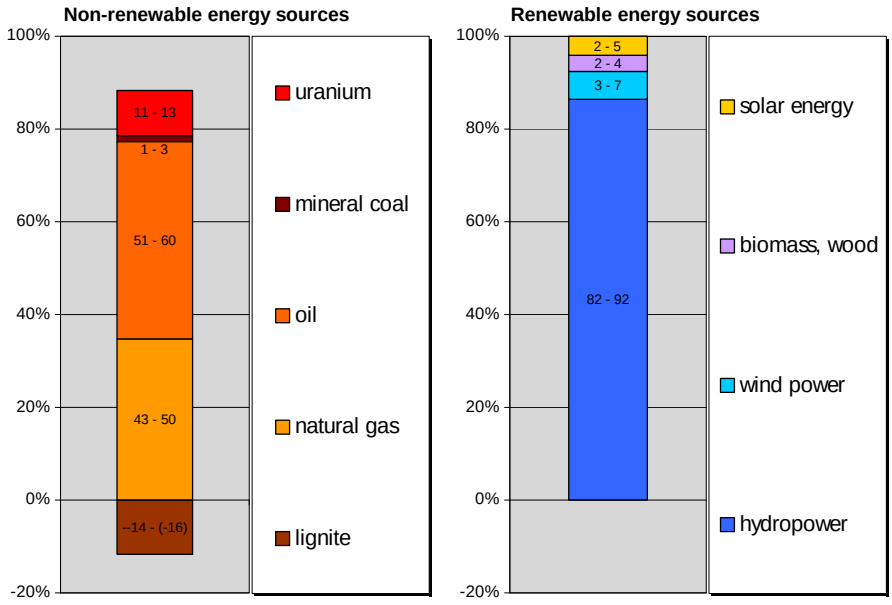
Graph 3 : Relative contributions of the life cycle stages to the regenerative and non regenerative primary energy consumption (Libra Lines)

Graph 4 differentiates the primary energy used from non-renewable and renewable raw materials for the production stage according to different partial processes of production. It shows that the predominant contribution to the primary energy consumption results from the provision of the raw materials for the production of the textile floor covering.



Graph 4: Relative contributions of production processes to the primary energy consumption

Graph 5 shows the respective share of the energy sources in the non-regenerative and in the regenerative primary energy input. Carpet waste is recovered in cement kilns. The organic matter of this waste is used as a secondary fuel and replaces part of the lignite used for the firing of the cement ovens. Lignite is also used for power generation (electricity used in the production process, see energy mix data /GaBi 4/ EU 15 power mix). The amount of lignite used for production of electricity is smaller than the amount that is saved in the cement oven, resulting in a negative overall value for lignite.



Graph 5 : Relative contribution of renewable and non-renewable energy sources

7.10.2 Non-renewable material content

The non-renewable raw materials used for the entire life cycle of the textile floor covering are fossil or mineral raw materials that are used for energy generation on the one hand and on the other hand are contained as raw material in the product .

The raw materials lignite, natural gas, oil, mineral coal and uranium are primarily used for energy generation; oil is furthermore used as a raw material for the production of polymeric materials. A differentiation of the raw materials according to their use is not made; these materials are recorded in chapter 7.10.1.

Other mineral raw materials are limestone with 2.9 kg/m^2, sodium chloride (rock salt) with 0.05 to 0.08 kg/m^2, clay with 0.02 kg/m² and colemanite ore with 0.015 kg/m², besides sulphur with 0.2 to 0.3 kg/m².

The non-utilisable ores and rocks, i.e. dead rock, account for 3.7 to 4.9 kg/m², the soil removal necessary for the production of the ores amounts to 0.2 kg/m², raw gravel to 0.1 kg/m².

The values indicated refer to product manufacture.

7.10.3 Water consumption

Table 15: **Water consumption* [m^3/m²]**

	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
Production	0.16	0.15	0.13	0.15	0.17	0.20
Delivery/installation	0.002	0.002	0.002	0.002	0.002	0.002
Usage	0.005	0.005	0.005	0.005	0.005	0.005
Disposal	-0.014	-0.015	-0.014	-0.015	-0.016	-0.017

* Credits from recovery of waste are included

Water is predominantly consumed during the manufacture of raw materials For the solution dyed products it amounts to 99 % referred to the production stage. For the continuous dyed product (Tempra) the share for manufacture of raw materials amounts to 85 % and the share for aqueous dying to 14 %.

7.10.4 Waste

Table 16: **Waste occurrence* [kg/m²]**

	Tempra	Air Master®	Stratos	Libra Lines	Scape	Mila
non-hazardous waste						
overburden/dump material						
Production	1.66	1.23	1.39	1.69	0.80	0.06
Delivery/installation	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39
Usage	0.47	0.47	0.47	0.47	0.47	0.47
Disposal	-26.9	-29.1	-26.7	-28.3	-29.6	-31.2
municipal solid waste						
Production	0.032	0.037	0.032	0.035	0.042	0.050
Delivery/installation	$1.0 \cdot 10^{-7}$	$1.0 \cdot 10^{-7}$	$1.0 \cdot 10^{-7}$	$1.0 \cdot 10^{-7}$	$1.0 \cdot 10^{-7}$	$1.0 \cdot 10^{-7}$
Usage	0.0	0.0	0.0	0.0	0.0	0.0
Disposal	$3.2 \cdot 10^{-4}$	$3.4 \cdot 10^{-4}$	$3.2 \cdot 10^{-4}$	$3.3 \cdot 10^{-4}$	$3.3 \cdot 10^{-4}$	$3.4 \cdot 10^{-4}$
hazardous waste						
special waste						
Production	$6.2 \cdot 10^{-3}$	$8.0 \cdot 10^{-3}$	$6.4 \cdot 10^{-3}$	$7.2 \cdot 10^{-3}$	$7.2 \cdot 10^{-3}$	$7.3 \cdot 10^{-3}$
Delivery/installation	$2.0 \cdot 10^{-3}$	$2.0 \cdot 10^{-3}$	$2.0 \cdot 10^{-3}$	$2.0 \cdot 10^{-3}$	$2.0 \cdot 10^{-3}$	$2.0 \cdot 10^{-3}$
Usage	0.0	0.0	0.0	0.0	0.0	0.0
Disposal	$4.3 \cdot 10^{-4}$	$4.6 \cdot 10^{-4}$	$4.3 \cdot 10^{-4}$	$4.5 \cdot 10^{-4}$	$4.5 \cdot 10^{-4}$	$4.6 \cdot 10^{-4}$
radioactive waste						
Production	$3.6 \cdot 10^{-3}$	$4.0 \cdot 10^{-3}$	$3.5 \cdot 10^{-3}$	$3.8 \cdot 10^{-3}$	$4.3 \cdot 10^{-3}$	$5.0 \cdot 10^{-3}$
Delivery/installation	$-4.4 \cdot 10^{-4}$	$-4.4 \cdot 10^{-4}$	$-4.4 \cdot 10^{-4}$	$-4.4 \cdot 10^{-4}$	$-4.4 \cdot 10^{-4}$	$-4.4 \cdot 10^{-4}$
Usage	$5.3 \cdot 10^{-4}$	$5.3 \cdot 10^{-4}$	$5.3 \cdot 10^{-4}$	$5.3 \cdot 10^{-4}$	$5.3 \cdot 10^{-4}$	$5.3 \cdot 10^{-4}$
Disposal	$-2.1 \cdot 10^{-4}$	$-2.3 \cdot 10^{-4}$	$-2.1 \cdot 10^{-4}$	$-2.2 \cdot 10^{-4}$	$-2.2 \cdot 10^{-4}$	$-2.3 \cdot 10^{-4}$

* Recovered waste is subtracted

Dump material is mainly overburden resulting from ore production for the generation of electric power; municipal solid waste essentially is mineral waste.

Hazardous waste includes special waste containing chemicals and toxic waste, and also radioactive waste which consist primarily of residues from ore processing that occur during the provision of electric power.

7.11 Life cycle impact assessment (LCIA)

The environmental impacts resulting from the production of 1 m² of Desso carpet tiles (100% PA6) are expressed in impact categories based on the /CML 2002/ method.

The following categories are considered:

Abiotic depletion potential (ADP)

The ADP indicator valuates the exploitation of limited fossile and mineral raw materials by calculating the relation of consumption to resource with a formula. The result is indicated in relation to the result for Antimon (Sb).

Global warming potential (GWP)

For the most frequent substances having an impact on the environment, the parameter GWP (global warming potential) is defined. The climate change was indicated for a time horizon of 100 years. The GWP describes the contribution of a substance to the greenhouse effect relative to the contribution of a like quantity of carbon dioxide (CO_2).

Ozone-layer depletion (ODP)

The depletion of the stratospheric ozone layer is caused primarily by chlorofluorocarbons (CFCs) and some chlorohydrocarbons and bromohydrocarbons. The reference substance used for the ozone depletion is the substance CFC R11, to which the ozone depletion potential (ODP) = 1 is allocated.

Acidification of soils and waters (AP)

The acidification potential indicates to which extent a component has an acidic effect. The acids are soluble in water and may rain down as acid rain. The various emissions within this category are related to sulphur dioxide (SO_2)-equivalents.

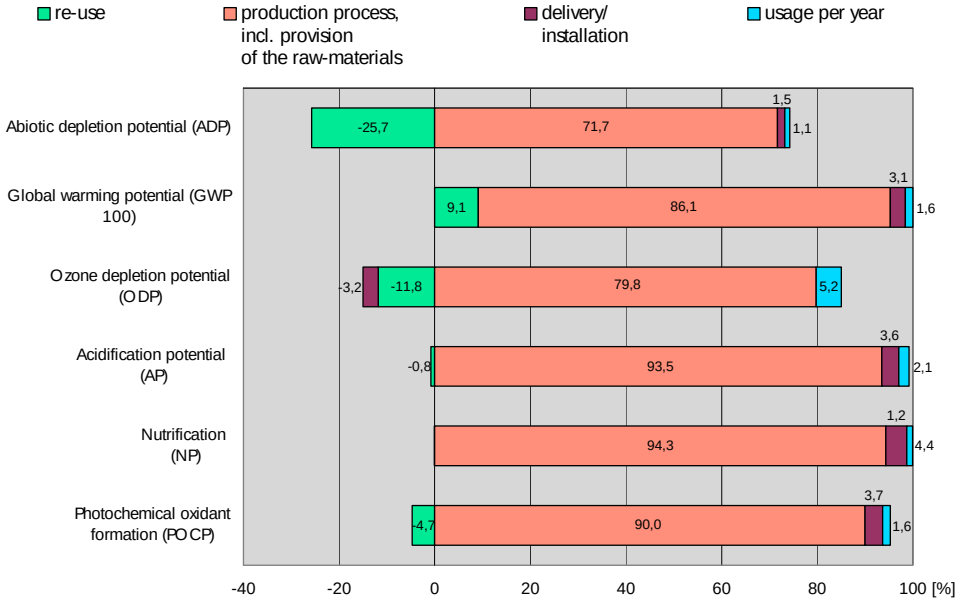
Nutrification (NP)

Nutrification is defined as the effect of excessive input of nutrients into the soil or water. Here, substances are considered that contain either nitrogen or phosphorus. The nutrification potential NP indicates the potential contribution of a substance to the production of biomass. The result is indicated in phosphate equivalents (PO_4).

Photochemical oxidant formation (POCP)

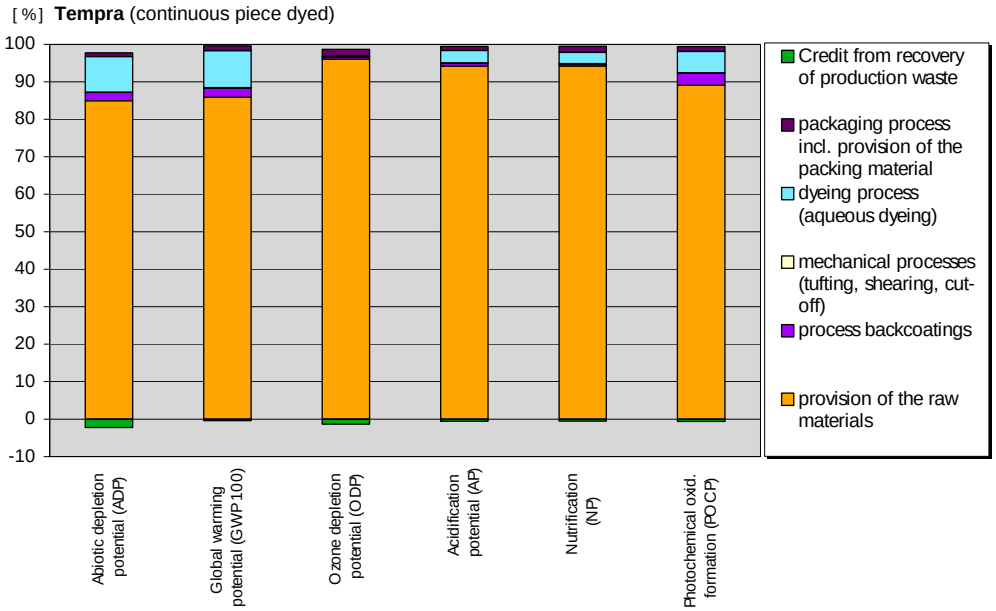
Summer smog is caused by the formation of photochemical oxidants in the lower troposphere. Summer smog is primarily caused through the reaction of hydrocarbons and nitrogen oxides (NOx) under solar radiation. The result is indicated in kilograms ethene equivalents, which is generated in the troposphere.

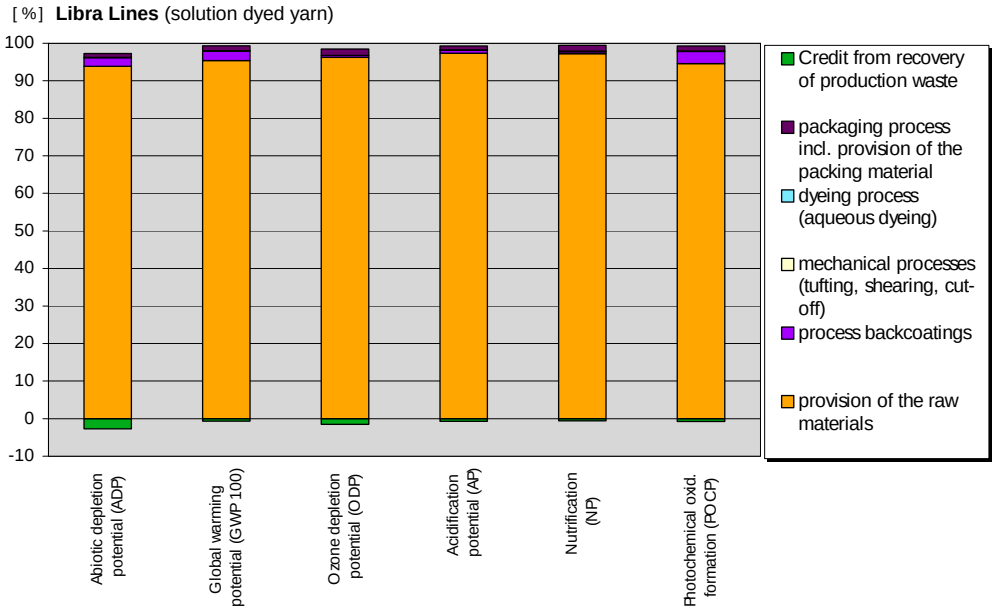
Graph 6 shows the relative contributions of the life cycle stages 'product manufacture', including the provision of the raw materials, 'delivery/installation', 'usage per year' and 're-use' to the impact categories described hereinbefore for environmental impacts.
The values include environmental impact and credit of each stage.



Graph 6: Relative contributions of the life cycle stages to the environmental impacts for Libra Lines

Graph 7 differentiates the share of the environmental impacts for the product manufacture from Graph 6 according to different processes of production.
For all impact categories, the major part of the contributions results from the provision of the raw materials.





Graph 7: Relative contributions of production processes to the environmental impacts

7.12 Interpretation Graphs 4 and 7 show that in current carpet tiles the provision of raw materials has the largest environmental impact over the carpet's life cycle, at least in the six categories that are investigated. The environmental impact rises almost linear with the amount of material input, mainly the polymer fibres.

8 Additional Information, verifications and test results

8.1 Commercial products covered within this Environmental Product Declaration

Table 17: **Products with similar construction**

as Stratos	**Product name**	Essence	Sienna	Pinto 580	Pure	Sand stripe	
	Prodis license number	835EB08F	C0CABFB B	6DC5A83F	EA6DAC3 A	5DF33509	
as Libra Lines	**Product name**	Sand	Patches				
	Prodis license number	C60BB094	FBED7C43				
as Scape	**Product name**	Neo	Neo Core	Supira	Tree	Libra Grooves	Trapez
	Prodis license number	9C9B4B76	AB317551	ECC96DE5	F2B8472B	BA2DE87B	B9C7EE6A
as Mila	**Product name**	Capella	Freestyle				
	Prodis license number	D2EFADEC	EB9543AF				

8.2 Emissions The emissions of the textile floor covering on delivery meet the requirements of the GUT test criteria for VOC emissions (Table 7) and contaminants.

For further information see: www.gut-ev.de and www.pro-dis.info

9 Literature

/Int.J.Life Cycle Assess/ Article from International Journal of Life Cycle Assessment ('A survey of unresolved problems in life cycle assessment'- J. Reap, F. Roman, S. Duncan, B. Bras - 2008)

/AgBB pattern/ Evaluation pattern of the AgBB (Committee for the Health-related Evaluation of Building Products) for VOC; procedure for the health-related evaluation of the emissions of volatile organic compounds (VOC and SVOC) from building products, BAM-Az 2006-3726, version of 2006.

/CML 2002/ Method "Centrum voor Milieukunde", Leiden, NL.

/EC1/ Association for Emission-controlled Installation Materials (GEV) - identification EMICODE EC1: very low emissions

/Ecoinvent/, Database, Swiss Centre for Life Cycle Inventories, Data Version 1.3.

/EN 685/ Resilient, textile and laminate floor coverings – classification

/EN 1307/ Textile floor coverings - classification of pile carpets,

/EN 14041/ Resilient, textile and laminate floor coverings – essential characteristics,

/GaBi 4/, Software and database for the preparation of life cycle assessments, Faculty of Building Physics (LBP) of the University of Stuttgart and PE International, Stuttgart, Echterdingen

/ISO 14040/ DIN EN ISO 14040: Environmental management – Life cycle assessment – Principles and frameworks.

/ISO 14025/ DIN EN ISO 14025: Environmental labels and declarations –Type III environmental declarations – Principles and procedures.

/DAAB/ Deutscher Allergie- und Asthmabund e.V., Mönchengladbach, Germany

/NL Patent/ Patent pending: NL 2002808.

/GUI/ Literature …

This declaration is based on the PCR document 'Floor Coverings'.

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