Environmental Product Declaration

as per ISO 14025 and EN 15804

Owner of the Declaration	**KEIM**FARBEN GmbH
Programme holder	Institut Bauen und Umwelt (IBU)
Publisher	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-KEI-2012111-E
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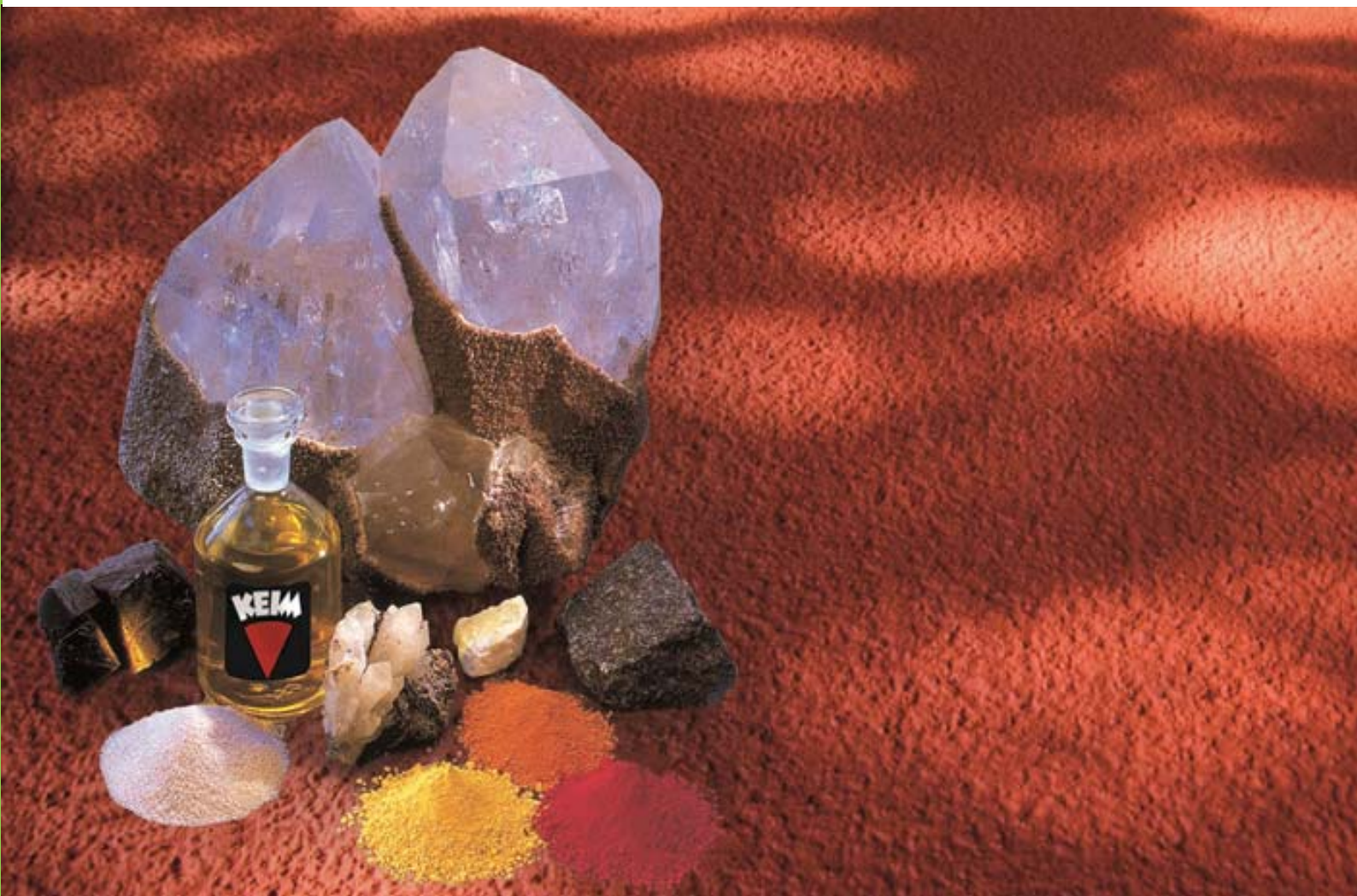
Valid to	29.11.2017

Silicate Internal Paint Systems

KEIMFARBEN GmbH

www.bau-umwelt.com

Institut Bauen und Umwelt e.V.



1 General information

KEIMFARBEN GmbH

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Rheinufer 108
D-53639 Königswinter

Declaration number
EPD-KEI-2012111-E

This Declaration is based on the Product Category Rules:
IBU PCR part A and PCR part B Rules for the creation of an EPD for coatings with organic binders, 7-2012
(PCR tested and approved by the independent expert committee SVA)

Issue date
30.11.2012

Valid to
29.11.2017

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of the Institute Construction and Environment)

Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of the SVA)

Silicate Internal Paint Systems

Owner of the Declaration
KEIMFARBEN GmbH
Keimstraße 16
86420 Diedorf

Declared product / Declared unit
1 m² internal paint

Scope:
This declaration refers to the product Biosil produced in the plant in Diedorf of the **KEIM**FARBEN GmbH. The Biosil declaration is representative for the silicate internal paint systems of the **KEIM**FARBEN GmbH Optil, Innotop, Ecosil-ME, Mycal-Top.

Verification

The CEN standard DIN EN 15804 serves as the core PCR
Verification of the EPD by an independent third party as per ISO 14025
☐ internally ☒ internally

Dr. Eva Schmincke
(Independent verifier appointed by the SVA)

2 Product

2.1 Product description

The specified KEIM internal paint systems within this declaration comply with the DIN EN 13300:2002 and fulfill the requirements of the DIN 18363:2010-4, para.2.4.1. The internal paint systems are mineral binders based on the silicate technology - a silification of the binders potassium water glass and silica sol with the underlying substrate in which a chemical reaction with the mineral fraction takes place. KEIM Biosil has been chosen as the representative product of internal paint systems of the **KEIM**FARBEN GmbH. KEIM Biosil also represents further KEIM internal paints: Optil, Innotop, Ecosil-ME and Mycal-Top.

2.2 Application

The declared products are used as internal paints.

2.3 Technical data

	Density [g/cm³]
Biosil	1.5
Optil	1.4
Innotop	1.4
Ecosil-ME	1.5
Mycal-Top	1.5

- The solid content is between 40 % and 65 %.
- The pH-value of all internal paints is approx. 11.
- The water vapour diffusion current density of all internal paints is >2000 g/m²d.(DIN EN ISO 7783-2:1999)
- The gloss level is between 0,5 and 4,2 (DIN EN ISO 2813:1999)

2.4 Placing on the market / Application rules

Provisions of VOB (Construction Contract Procedures) following ATV (General Technical Conditions of Contract) DIN 18363:2010-4 for paintings- and varnishing works– coatings as well as DIN EN 13300:2002.

2.5 Delivery status

The declared products are transported as liquid, ready for use products in white or in various shades of colors in buckets made of Polypropylene with 5 l or 15 l containers.

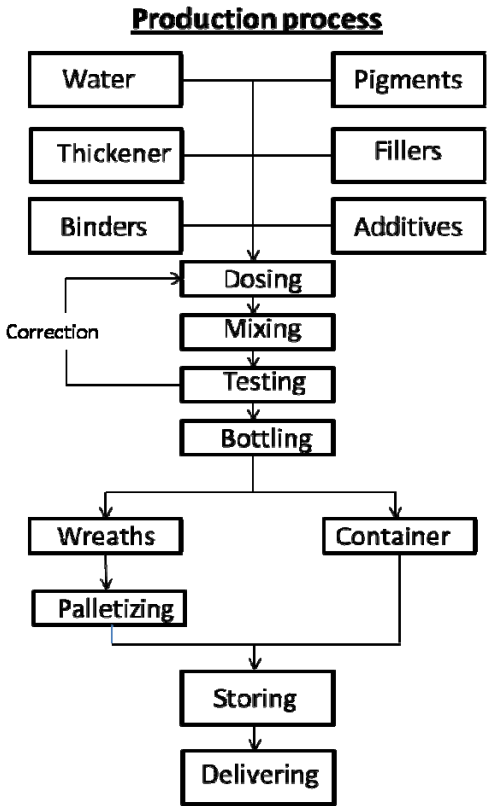
2.6 Base materials / Ancillary materials

Selected, natural raw materials form the basis for the high quality of KEIM silicate paints.

Base materials of all internal paints are water, inorganic pigments, thickening agents, fillers, binders and additives. For ancillary materials, special fixatives or dilution are added to particular internal paints.

Binders	15 – 35 %
Fillers	20 – 45 %
Water	20 – 35 %
Pigments	5 – 15 %
Other components	1 – 5 %

2.7 Manufacture



The figure shows the following working process during the production of internal paint systems: First, the silos and weighting containers are filled, followed by transportation and adjustment of raw material into the mixer for dispersion. After a quality control, the internal paints are filled into containers. Then they are loaded and delivered.

KEIMFARBEN GmbH has certified their quality management system according to ISO 9001:2008.

2.8 Environment & Health during manufacturing

KEIMFARBEN GmbH fulfills all required national regulations regarding consumer health and environmental protection. The environmental management system is certified according to ISO 14001:2004.

A risk to environment or negative effects on technical production staff during the production process of internal paint does not exist, particularly due to the decision not to use toxic biocides and additional VOC's.

2.9 Product processing / Installation

For application, silicate internal paints are processed manually or mechanically by different tools. In this context, the following subsoil and dilution products are used:

Biosil	water
Optil	water
Innotop	water
Ecosil-ME	Special fixative
Mycal-Top	Special fixative

2.10 Packaging

By default, internal paint systems are packaged in buckets made of Polypropylene (5 l or 15 l).

2.11 Condition of use

KEIM internal paints have a mineral dull surface; they are highly diffusible, free of emissions, solvents and plasticizers. In addition, they are mechanically highly loadable, resistant to mould (because they are minerally alkaline), without the addition of preservatives and without foggingsactive substances produced.
KEIM internal paints are extremely porous with a micro porous structure. Thus, moisture can be absorbed unhindered through the color coat by the wall, stored and gradually be released. Painted walls using KEIM internal paints remain dry even under high humidity – a fundamental requirement for a healthy indoor climate and very important to avoid mould damage.
KEIM internal paints are antistatic. The mineral pigments and binders are highly durable. They remain color-stable and lightfast with an high luminosity and natural look.

2.12 Environment & Health during use

Internal paints are not subject to labelling. They do not release any polluting emissions.

Moreover, the products Optil and Biosil have a naturplus-certificate. Mycal-Top, ecosil-ME and Optil hold test certificates, which prove resistance against mould and fungal attack. The suitability for allergy sufferers has been certified for Biosil by the IUG (Institute for environment and health) and for Ecosil-ME and Mycal-Top by the TÜV Nord. These latter three products have a LGA-cetrificate for the safety of foodstuffs for human consumption.

2.13 Reference service life

The reference service life for internal paint systems of the company **KEIM**FARBEN GmbH has been determined to 30 years. However, the internal paint systems can reach a service life of 100 years.

Due to properties of KEIM internal paint systems mentioned in point 2.11 a premature ageing is delayed.

2.14 Extraordinary effects

Fire

Biosil	non-flammable
Optil	non-flammable
Innotop	non-flammable
Mycal-Top	non-flammable
Ecosil-ME	non-flammable

The colors are non-flammable. Thus, they fulfill the criteria of class A2 according to DIN 4102-A2:1998 and A2-s1-d0 according to DIN EN 13501-1:2010.

Even during the strongest exposure to flames, KEIM internal paints do not ignite. This means in the event of fire: maximum safety and no toxic gases.

Water

No negative effects are expected after the curing of the silicate coating material.

2.15 Re-use phase

KEIMFARBEN can reach the life time of buildings. It is sufficient to clean the wall with water.

Internal paint systems do not have a real subsequent use stage. The disposal is carried out in combination with parts of the building. If these are solely construction waste, recycling according to national contexts takes place. Normally, construction waste is crushed and as substitution for fillings returned to the economic cycle (road construction, concrete).

2.16 Disposal

Disposal of unprocessed internal paint, respectively remaining color, is handled according to official regulations.

The waste code according to the European waste list is:

08 01 12 valid for all internal paint systems.

2.17 Further information

Homepage: www.keimfarben.de

On the website technical data sheets, safety data sheets and further information can be downloaded.

3 LCA: Calculation rules

3.1 Declared unit

The declared unit is 1 m².

The conversion to kilogramme is the result of the colors' density. The density as well as the painting quantity in kg per m² are shown in the following table.

	Density [g/cm³]	Painting quantity [kg/m²]
Biosil	1.5	0.33
Optil	1.4	0.36
Innotop	1.4	0.44
Ecosil-ME	1.5	0.39
Mycal-Top	1.5	0.38

3.2 System boundary

Type of EPD: Cradle to grave.

The following modules have been taken into account for the calculation of the life cycle assessment.

A1	Raw material supply
	Packaging and disposal
A2	Transport of raw material
A3	Manufacturing of paintings (incl. energy and water)
	Production of packaging (buckets made of Polypropylene)
A4	Transport to construction site
A5	Installation of the colors
	incl. production and transport of ancillary material (e.g. grounding)
	Waste processing of packaging (buckets made of Polypropylene)
B1	Usage of colors, emissions during usage
D	Reuse-, Recovery-, Recyclingpotential

3.3 Estimates and assumptions

For all known production processes primary data was used wherever possible. Estimations, which means using generic data, were made for composition material with less than five percent by mass of the total composition and less than one percent by mass for every single one.

Assumptions were made for the modules A4 (Transport to construction site; 350 km and 85 % load), A5 (Installation; for varnishes the lowest dilution was assumed, so that their intensity of color is similar to the intensity of color of the other internal paint systems as well as waste processing; 100 % of buckets are incinerated) and B1 (Usage; maximum on labels stated VOC-emissions).

3.4 Cut-off criteria

The use of cut-off rules for the producer's primary data was avoided. In fact, smaller amounts of input material (in total less than five percent by mass) were calculated as generic data within the life cycle assessment.

3.5 Background data

For the calculation of the life cycle assessment, respectively of the life cycle of internal paint systems, the software system „GaBi 4" (Ganzheitliche Bilanzierung) developed by PE INTERNATIONAL AG has been used. The data set is compiled by PE itself or by ecoinvent.

3.6 Data quality

Data quality can be considered to be high, because every primary product has a corresponding data set which was either provided by the producer of the particular primary product or generated by using material safety data sheets and information of **KEIM**FARBEN GmbH.

Background data of PE and ecoinvent is in general less than 10 years old.

3.7 Period under review

The selected observation period is the year 2010. All in-house data was collected for this period.

3.8 Allocation

The input energy, ancillary and operating materials, as well as packaging material of ingredients were physically allocated to the paintings, considering the amounts produced in 2010 (A1).

In addition, benefits were calculated both for the recycling and for the thermal and energetic utilization of the packaging material. This has been declared in module D and relates to the packaging of raw materials (module A1) and the packaging of the finished paintings (module D).

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were developed according to EN 15804 and the context of construction, respectively the product-specific characteristics of performance, are taken into account.

4 LCA: Scenarios and additional technical information

Following technical information are basis for the declared modules or can be used for the development of specific scenarios in the context of an evaluation of a building, if modules are not declared (MND).

Transport to construction site (A4)

Transport distance	350 km
Load (including empty truck movements)	85 %

Installation in the building (A5)

Paint	Ancillary material	Amount [kg/m²]
Biosil	Water	0.02
Optil	Water	0.02
Innotop	Water	0.03
Ecosil-ME	Spezial-Fixativ	0.02
Mycal-Top	Spezial-Fixativ	0.02

Material loss of all internal paint systems/ancillary materials: 0 %

Assumption: application of paint twice, with the maximum amount of paint according to the technical data sheet.

Paint buckets - Return as municipal or commercial waste - 100% used for incineration with energy recovery.

Use (B1)

See chapter 2.12 Usage

Further use stages (B2, B3, B4, B5, B6, B7)

none

Reuse-, Recovery- and Recycling potential (D)

All packaging material (of raw materials and paint) is disposed in accordance with national conditions (considered area: Germany).

The main components of steel and cardboard, as well as about 40 % of plastics (packaging of raw materials) will be recycled. Inert waste is assumed to end up at landfills and the remaining waste is used for incineration with energy recovery.

5 LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED; MND = MODULE NOT DECLARED)																
PRODUCT STAGE			CONSTRUC-TION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m² KEIM Soldalit								
Parame-ter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**D**
GWP	[kg CO_2-eq.]	2.56E-01	1.49E-02	6.09E-02	5.64E-03	3,13E-02	1.65E-03	-2.53E-02
ODP	[kg CFC11-Äq.]	4.92E-08	2.40E-09	3.12E-09	9.95E-12	4,05E-11	0.00E+00	-2.06E-09
AP	[kg SO_2-eq.]	1.41E-03	8.09E-05	2.02E-04	2.48E-05	4,51E-06	0.00E+00	-3.00E-05
EP	[kg PO_4^{3-}-eq.]	7.05E-04	2.47E-05	1.83E-05	5.68E-06	8,79E-07	0.00E+00	-3.24E-06
POCP	[kg Ethen eq.]	1.36E-04	1.25E-05	1.94E-05	2.49E-06	4,53E-07	5.82E-05	-3.14E-06
ADPE	[kg Sb eq.]	9.34E-07	3.77E-08	-1.29E-08	1.90E-10	1,07E-09	0.00E+00	-3.47E-09
ADPF	[MJ]	4.53E+00	2.21E-01	1.12E+00	7.76E-02	1,09E-02	0.00E+00	-3.15E-01
Caption	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							

RESULTS OF THE LCA - RESOURCE USE: 1m² KEIM Soldalit								
Parame-ter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**D**
PERE	[MJ]	2.52E-01			8.57E-05	2,16E-04	0.00E+00	-7.33E-03
PERM	[MJ]	0.00E+00			0.00E+00	0,00E+00	0.00E+00	-1.50E-03
PERT	[MJ]	2.18E-01	3.11E-03	3.03E-02	8.57E-05	2,16E-04	0.00E+00	-8.84E-03
PENRE	[MJ]	6.57E+00			7.89E-02	-2,44E-02	0.00E+00	-1.70E-01
PENRM	[MJ]	5.59E-01			0.00E+00	3,72E-02	0.00E+00	-2.70E-01
PENRT	[MJ]	5.47E+00	2.35E-01	1.43E+00	7.89E-02	1,29E-02	0.00E+00	-4.40E-01
SM	[kg]	-	-	0.00E+00	-	0,00E+00	-	-
RSF	[MJ]	-	-	0.00E+00	-	0,00E+00	-	-
NRSF	[MJ]	-	-	0.00E+00	-	0,00E+00	-	-
FW	[m³]	8.10E-03	1.16E-04	6.12E-04	2.98E-07	8,59E-05	0.00E+00	-2.62E-05
Caption	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							

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1m² KEIM Soldalit								
Parame-ter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**D**
HWD	[kg]	2.41E-04	0.00E+00	3.22E-05	0.00E+00	7,06E-06	0.00E+00	1.42E-06
NHWD	[kg]	8.01E-02	0.00E+00	9.93E-02	3.88E-04	8,54E-04	0.00E+00	6.69E-02
RWD	[kg]	2.91E-05	0.00E+00	3.92E-05	1.24E-07	3,55E-07	0.00E+00	2.58E-05
CRU	[kg]	-	-	0.00E+00	-	-	-	-
MFR	[kg]	-	-	3.68E-03	-	-	-	-
MER	[kg]	-	-	2.19E-03	-	-	-	-
EEE	[MJ]	-	-	4.49E-03	-	-	-	5.60E-02
EET	[MJ]	-	-	1.37E-02	-	-	-	1.83E-01
Caption	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; EEE = Exported energy electrical; EET = Exported energy thermal							

6 LCA: Interpretation

For the interpretation of the results of the life cycle assessment both the aggregated indicators of the inventory and the impact assessment are presented and analyzed in a dominance analysis .

Basically, it can be stated that the environmental impacts of all internal paints are comparable.

A similar pattern is found for energy consumption, as well as for every other impact category. The results are dominated by the environmental impacts of the raw material, respectively by the related primary energy demand. Only 6 % of the total energy is consumed by **KEIM**FARBEN GmbH itself, whereas about 70 % of primary energy is demanded by the raw materials.

Determining for this performance are titanium dioxide (used as a pigment), in particular its production, the organic binders, as well as the packaging material of the raw material. Another non negligible amount of 8 % of total energy is caused by the production of the binder potassium water glass, which is an important component of Biosil.

The elementary abiotic resource depletion potential for non fossil resources (ADPE) is influenced by raw materials with more than 90 %. Most decisive for this category is the application of pigments, organic binders and packaging. The remaining amount of ADPE is due to the transport of packaging.

Regarding the fossil abiotic resource depletion, 70 % are related to raw materials, compared to 20 % caused by the production within **KEIM**FARBEN itself. This is mainly because of fossil fuels used for the power generation in Germany. Together, the transport of raw materials and paintings accounts for almost 10 %.

The global warming potential (GWP) is caused with more than 60 % by emissions related to raw materials and their production, with 5 % by emissions during manufacturing, and with 8 % by emissions due to the incineration of the bucket. The remaining emissions are caused by transport and the emissions during usage, as well as the production of wreaths made of Polypropylene. The prevented emissions due to incineration with energy recovery amount to about 6 %.

Both, the ozone depletion potential (ODP) and the acidification potential (AP) are dominated by the environmental impact of raw materials with about 80 %. However, it has to be considered that in particular ODP shows very small absolute values and thus, it is relatively unimportant. The impact is basically caused by the energy supply.

The eutrophication potential (EP) is caused with 90 % by impacts of the raw material and with 10 % by the transport of raw materials and the manufacturing within the company. The result is dominated by the pigment titanium dioxide (79 %), organic binders (5 %) and potassium water glass (5 %).

The impact of photochemical ozone creation potential (POCP) is, overall, very small. The POCP is caused by raw materials with about 60 % and by transport and manufacture with about 15 %. Additionally, approximately 25 % of POCPs are related to the use phase. The VOC-emissions are less than 0.25 g per m².

7 Requisite evidence

7.1 VOC emissions

As a condition of the receipt of the Natureplus-certificate, chamber tests per DIN EN ISO 16000-9:2008 were implemented by TÜV Süd industry services (audit report 101119-1 19.11.2010). All requirements were fulfilled, including the health criteria for building products of the AgBB (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten). The results of VOC emissions, shown in the table below, refer to measurements after 7 days. The research was terminated prematurely, because the measurement values came out to be already less than 50% of the 28-days critical change value.

VOC emissions

AgBB - results	**28 days [µg/m³]**
TVOC (C6 - C16)	146
sum of SVOC (C16 - C22)	8
R (dimensionless)	0,123
VOC without NIK	33
Kanzerogene (3 days)	n.d.*

n.d. = not detected; detection limit = 1 µg/m³

7.2 Fire gas toxicity

KEIM Biosil fullfills the requirements of the construction material class A2 for non-flammable building materials according to DIN 4102-1 and expert reports of the Institute for coating and painting technology (iba). Flue gas emissions occur rarely or not at all.

7.3 Suitability for allergy sufferers

The Institute for environment and health (IUG) proved with their product label „Allergiker-geeignet“, the suitability of KEIM Biosil as an interior paint system for allergy sufferers during a test in November 2011.

KEIM Ecosil-ME and KEIM Mycal Top were marked with the TÜV Nord test label „Innenraumfarbe aus allergen- und schadstoffkontrolliertem Material – Für Allergiker geeignet“, in October 2012.

8 References

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Part B: Requirements on the EPD for Coatings with organic binders.

www.bau-umwelt.de

DIN EN ISO 14025:2009-11, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

DIN EN 15804:2012-04, Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products

DIN 4102-1:1998-05, Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests

DIN EN 13501-1:2010-01, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

DIN EN 13300:2002, Paints and varnishes - Waterborne coating materials and coating systems for interior walls and ceilings – Classification

DIN 18363:2010-4, German construction contract procedures (VOB) - Part C: General technical specifications in construction contracts (ATV) - Painting and coating work

DIN EN ISO 7783-2:1999, Paints and varnishes - Determination of water-vapour transmission properties - Cup method (ISO 7783:2011)

DIN EN ISO 2813:1999-06, Paints and varnishes - Determination of specular gloss of non-metallic paint films at 20°, 60° und 85° (ISO 2813:1994, including Technical Corrigendum 1:1997)

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Publisher
Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 29 66 79- 0
Fax +49 (0)2223 29 66 79- 0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Programmeholder
Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 29 66 79- 0
Fax +49 (0)2223 29 66 79- 0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Owner of the Declaration
KEIMFARBEN GmbH
Keimstraße 16
86420 Diedorf
Germany

Tel. +49 (0)821 4802- 0
Fax: +49 (0)821 4802- 210
E-mail: info@keimfarben.de
Web **www.keimfarben.de**

Author of the Life Cycle Assessment
TÜV Rheinland LGA Products GmbH
Am Grauen Stein 29
51105 Köln
Germany

Tel. +49 (0)911 655 5225
Fax: +49 (0)911 655 5226
E-mail: service@de.tuv.com
Web **www.tuv.com**