ZAG EPD

Environmental Product Declaration

According to ISO 14025 and EN 15804:2012+A2:2019

Kerrock solid surface

ECO PLATFORM EPD EN 15804 VERIFIED

EPD number	EPD-21/0004
EPD owner	KOLPA d.o.o., Rosalnice 5, 8330 Metlika, Slovenia
EPD Program operator	ZAG EPD
Issue date	8. 12. 2021
Valid until	7. 12. 2026

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ZAVOD ZA GRADBENIŠTVO SLOVENIJE LJUBLJANA 17

General information	Kerrock solid surface
Program holder: Slovenian National Building and Civil Engineering Institute - ZAG Dimičeva ulica 12 1000 Ljubljana http://www.zag.si	**Owner of the Environmental Product Declaration:** KOLPA d.o.o. Rosalnice 5 8330 Metlika Slovenia https://www.kolpa.si/en/
Number of the Environmental Product Declaration: EPD-21/0004	**Declared unit:** 1 m^2 of Kerrock solid surface for a period of 10 years in use
This Environmental Product Declaration is based on the Product Category Rules (PCR): Product Category Rules (PCR) Part B: Requirements on the EPD for Sanitary products made from composite materials. Institut Bauen und Umwelt e.V.	**Scope:** A1-A3, A4, A5, B1-B7, C1, C2, C3, C4, D
Issue date: 8. 12. 2021 **Valid until:** 7. 12. 2026	**Verification:** The CEN standard SIST EN 15804 serves as the core Product Category Rule (PCR) Independent verification of the EPD according to EN ISO 14025 ☒ internal ☐ external
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1 Product

1.1 Product description

Kerrock is a solid composite material composed of ~2/3 inorganic filler (aluminium trihydrate – ATH, obtained from bauxite ore) and ~1/3 acrylic binder (methylmethacrylate – MMA). It creates the impression of natural granite or marble, but it is non-porous. As a surface material, Kerrock solid surface products are appreciated due to their versatility, functionality and durability. Kerrock is antibacterial and health-friendly material, moreover it is also distinguished by the pleasantness of touch, mechanical resistance, water resistance, resistance to chemicals, weather resistance and thermal resistance.

The Kerrock solid surface product group covers products such as cladding pannels for interior and exterior, washbasins, kitchen sinks, countertops etc. The Kerrock solid surface products can be used in a variety of residential (kitchens, bathrooms) and commercial applications. The Kerrock solid surface is suitable for use in hotels, restaurants, laboratories, hospitals, business premises, schools, kindergartens, shops and shopping centers, façade and wall covering.

1.2 Technical Data

Kerrock is a composite material made in the form of sheets of various dimensions and densities.

Detailed technical characteristics of Kerrock are indicated in Table 1.

The National Laboratory of Health, Environment and Food (NZLOH), the central Slovenian public health laboratory, which is involved in hygienic and medical/ecological activity, confirmed that Kerrock is a safe material for any type of food contact without presenting a risk to health.

The reaction to fire of the Kerrock material in the construction sector was proven by an analysis addressing its behaviour in the initial fire phase. Tests were conducted in line with the requirements stipulated in the EN 13501-1 (Euroclass System) European standard.

The Kerrock material was also tested for smoke development and toxicity in accordance with the Resolution MSC: 61 (67), FTP code, Attachment 1, Part 2. The company Exova Warringtonfire performed the respective tests and the Kerrock material meets the requirements of IMO FTPC, Part 2, Section 2.6.1.1 Smoke and Section 2.6.2 Toxicity in smoke development and toxicity. This demonstrates the suitability of using Kerrock material for partitions, claddings or ceilings.

1.3 Base materials

The basic materials for the production of Kerrock are:

- aluminum trihydrate derived from bauxite ore (57-65 wt%),
- acrylic polymer, known as methylmethacrylate (33-42 wt%) and
- other ingredients such as titanium dioxide and pigment paste (1-3 wt%).

1.4 Manufacturing process

Kerrock production is divided into several stages beginning with raw material preparation and following with manufacture of the product. These stages are:

- silanization and sieving of aluminium trihydrate,
- manufacture of acrylic resin from methylmethacrylate (MMA),
- preparation of Kerrock chips (crushing and sieving),
- preparation of dispersions,
- polymerization of sheets- and bowls,
- cutting and grinding of sheets/bowls/tubs,
- packaging of the final product (Kerrock solid surface sheets, tubs or bowls).

1.5 Packaging

The Kerrock is packed with polyethylene foil and edges are protected with cardboard. The packages are stacked on wooden palettes.

1.6 Product installation

For cutting Kerrock standard sheets, squaring circular saws are mostly used. For gluing Kerrock elements together, a two-component acrylic adhesive is used.

1.7 Further information

The owner of the declaration shall be liable for the underlying information and evidence. Further information about the Kerrock is also available in the manufacturer web page:
https://www.kolpa.si/en/

Table 1: Technical characteristics of Kerrock solid surface

Kerrock solid surface	Technical data
Thickness	6-27 mm
Sheet length	180-3600 mm
Sheet width	760 – 1600 mm
Density (SIST EN ISO 1183-1)	1680-1750 kg/m^3
Flexural modulus (SIST EN ISO 178)	8600-9200 MPa
Flexural strength (SIST EN ISO 178)	49-80 MPa
Tensile strength (SIST EN ISO 527-2)	36-50 MPa
Charpy impact strength (SIST EN ISO 179-1)	3,0-6,0 kJ/m^2
Hardness (Barcol impresor) (SIST EN 59)	58-64
Linear expansion coefficient (-20°C to 50°C)	3,3-4,2 x 10^{-5} K^{-1}
Water absorption (after 24 hours) (SIST EN ISO 62)	0,03-0,05%
Resistance to steam (SIST EN 438-2)	5 (no visible change)
Resistance to dry heat (SIST EN 438-2)	5 (no visible change)
Resistance to cigarette burns (SIST EN 438-2)	4 (slight change of gloss, only visible at certain viewing angles and/or slight brown stain)
Colour constancy (ISO 19712-2)	Pass
Resistance to stains/chemicals (ISO 19712-2)	Pass
Hot/cold cycle water resistance (ISO 19712-2)	Pass
Ability to renewed (ISO 19712-2)	Pass
Classification of material response to fire (SIST EN 13501-1)	B-s1, d0
Food contact (SIST EN 13501-1) in accordance of Commission Regulation(EU) No. 10/2011 /EU and of Regulation (EC) No. 1935/2004 at the European Parliament	Kerrock material is suitable for contact with food
Lightfastness (ISO 1972-2)	Pass

2 Product photos

Figure 1: Kerrock solid surface in its various applications

3 LCA: Calculation rules

3.1 Declared unit

The declared unit was defined in accordance with Product Category Rules (PCR) Part B: Requirements on the EPD for Sanitary products made from composite materials, which are issued by the Institut Bauen und Umwelt e.V. The following declared unit was applied:
1m² of 12-mm thick Kerrock solid surface for a period of 10 years in use.
The density of the Kerrock sheet is 1700 kg/m³ and the mass is 20.4 kg.

3.2 System boundary

System boundaries were defined in accordance with the modular principle described in the European standard for Environmental Product Declarations (EPD): EN 15804:2012+A2:2019. This analysis LCA is based on cradle-to-grave (Figure 2). The LCA of Kerrock solid surface covers all life cycle stages:
A1: raw material extraction and processing;
A2: transport to the manufacturer;
A3: manufacturing;
including 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 production stage;
A4: transport to the installation site;
A5: installation process;
including 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 process stage. These information modules also include all impacts and aspects related to any losses during this construction process stage (i.e. production, transport and waste processing and disposal of the lost materials);
B1: use or application of the installed product;
B2: maintenance;
B3: repair;
B4: replacement;
B5: refurbishment;
B6: operational energy use;
B7: operational water use;
including 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 process stage. These information modules also include all impacts and aspects related to any loss during this construction process (i.e. production, transport, and waste processing and disposal of the lost products and materials);
C1: de-construction, demolition;
C2: transport to waste processing;
C3: waste processing for reuse, recovery and/or recycling;
C4: disposal;
including provision and all transport, provision of all materials, products and related energy and water use;
D: reuse, recovery and/or recycling potentials, expressed as net impacts and benefits.

The data used for modules A1-A3, A4-A5 and B1-B7 are based on the measured quantities provided by the manufacturer, while data used for modules C1-C4 and D are partly based on the information provided by the manufacturer and partly on the information indicated in revised EN 15804:2012+A2:2019 standard.
Kerrock installation requires electricity for circular saw. The Kerrock solid surface is installed with Kerrock two-component adhesive. 20% of waste material is assumed to be generated from the product installation.
During use stage, maintenance of Kerrock soid surface is required; i.e. cleaning with tap water and soap. While repair, replacement or refurbishment of the Kerrock solid surface during use are not required in standard conditions, if the product properly installed. No operational energy or water use is required. The Kerrock solid surface does not cause release of any substances to indoor air, soil and water in the use stage.

Typically, dismantling of the Kerrock solid surface is conducted manually. The environmental impacts related with dismantling of the product are assumed to be zero, as no electricity or fuel is required.

Waste Kerrock material is disposed on landfill for construction waste. The waste Kerrock is inert waste material.

Benefits beyond the product system boundary are associated with recycling of waste packaging materials, waste steel parts of filters and waste bottles/cartridges made from plastic for storage of Kerrock adhesive (i.e. glue).

Benefits beyond the product system boundary refer also to energy recovery from incinerating the waste polyethylene foil generated from the product installation and incineration of wooden paletts.

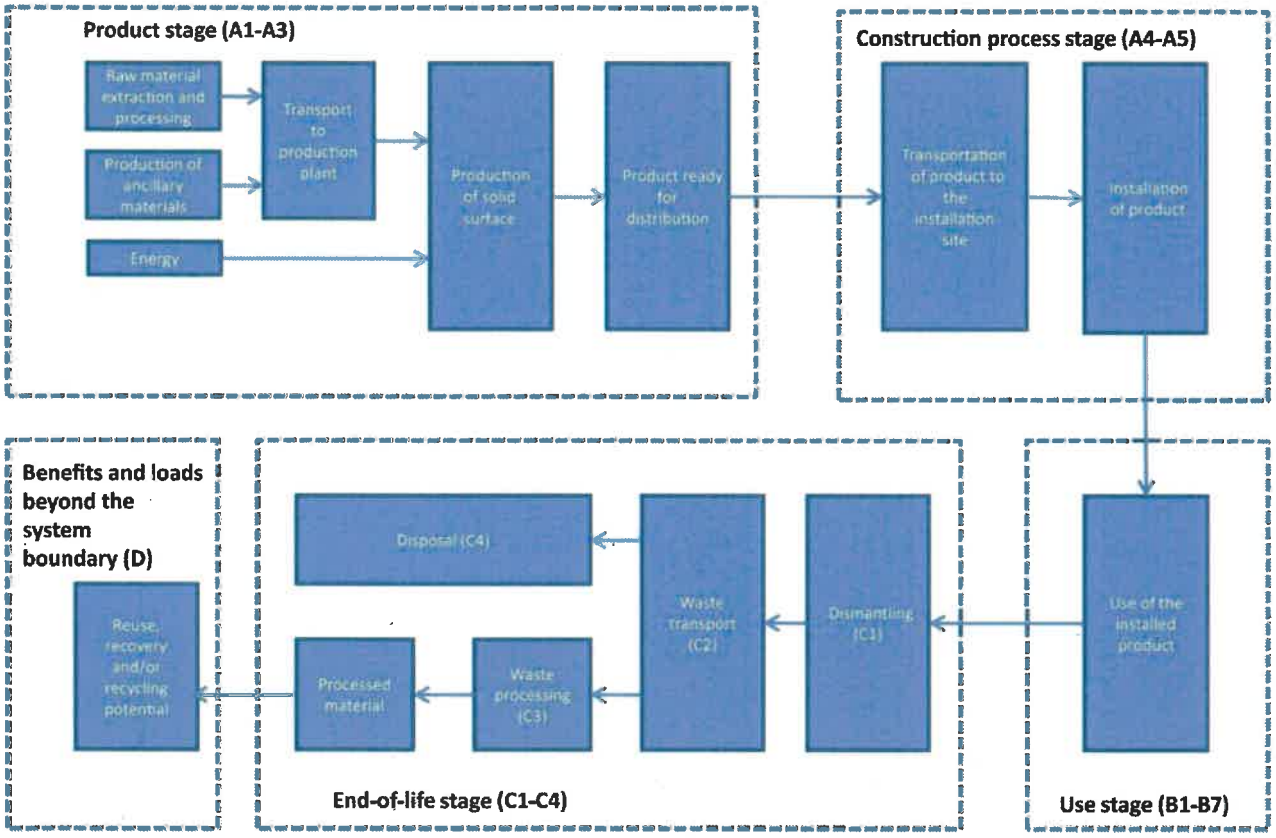

Figure 2: Schematic representation of the system boundaries

3.3 Cut-off rules

The exclusion of inputs and outputs was conducted in accordance with the cut-off rules defined in the standard EN 15804:2012+A2:2019:

- All inputs and outputs to the studied system have been included in the calculation, for which data are available;

- In case of insufficient input data or data gaps for a unit process, the cut-off criteria has been 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows per module has been a maximum of 5% of energy usage and mass.

3.4 Background data

The LCA analysis was conducted with the GaBi ts (version 10.0.1.92) modelling software, which was developed by Thinkstep (Sphera Solutions GmbH). All processes were modelled based on inventory data given in the GaBi Professional database, except production of pigment paste, black. Building blocks of the pigment paste are partly based on datasets from Professional database and partly on datasets from the ecoinvent 3.7 database. The reason for this is lack of inventory data of required building blocks in GaBi Professional database.

3.5 Data quality

The quality of the data used for calculations within the LCA analysis corresponds to the requirements of EN 15804:2012+A2:2019:

- Generic data have been checked for plausibility;
- Data sets are complete according to the system boundary within the limits set by the criteria for the exclusion of inputs and outputs;
- Data is as current as possible. Data sets used for calculations are valid for the current year and represent a reference year within 10 years for generic data and 5 years for producer specific data;
- The reference year refers to the year which the overall inventory best represents, considering the age/representativeness of the various specific and background data included, i.e. not automatically the year of modelling, calculation or publication year. Validity refers to the date to which the inventory is still judged sufficiently valid with the documented technological and geographical representativeness;
- All datasets are based on 1 year averaged data;
- The time period over which inputs to and outputs from the system has been accounted for is 100 years from the year for which the data set is deemed representative.

3.6 Period under review

The reference year for the data collected for this LCA analysis is 2020.

3.7 Allocation

There are no co-products in the production process of Kerrock solid surfaces. Therefore, no allocation procedure has been required in this regard.

3.8 List of substances

Kerrock sheets, bowls, adhesive (glue), as supplied by company Kolpa does not contain any substances identified as Substances of Very High Concern (SVHC) as defined by Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) in quantities over 0,1% in weight.

4 Additional technical information

4.1 Information on describing the biogenic Carbon Content at factory gate

There are no biogenic carbon containing materials in the product. While a mass of biogenic carbon containing materials in the packaging and in wooden paletts is 1.11 kg, which is 43% of the total mass of the packaging and paletts.

Table 2: Information on biogenic carbon content at the factory gate

BIOGENIC CARBON CONTENT	Unit [expressed per declared unit]
Biogenic carbon content in product	0 kg C
Biogenic carbon content in accompanying packaging	1.11 kg C

**1 kg biogenic carbon is equivalent to 44/12 kg CO_2.*

5 LCA: Results

Table 3: Selected phases of the LCA

SYSTEM BOUNDARY																
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
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
☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
The modules of the product lifecycle, which are included in EPD are marked by "X"																

5.1 Indicators of environmental impacts

According to the standard EN 15804:2012+A2:2019, the environmental impacts are presented with seven indicators (Table 4).

Table 4: Abbreviations and units of indicators of environmental impacts

Indicators of environmental impacts	Abbreviation	Unit
global warming potential-total	GWP-total	kg CO_2 equiv.
global warming potential-fossil fuels	GWP-fossil	kg CO_2 equiv.
global warming potential-biogenic	GWP-biogenic	kg CO_2 equiv.
global warming potential-land use and land use change	GWP-luluc	kg CO_2 equiv.
ozone depletion	ODP	kg CFC 11 equiv.
acidification of soil and water	AP	kg mol H^+ equiv.
eutrophication aquatic freshwater	EP-freshwater	kg PO_4 equiv.
eutrophication aquatic marine	EP-marine	kg N equiv.
eutrophication terrestrial	EP-terrestrial	mol N equiv.
photochemical ozone formation	POCP	kg NMVOC equiv.
depletion of abiotic resources - minerals and metals	APD-minerals&metals	kg Sb equiv.
depletion of abiotic resources - fossil fuels	APD-fossil	MJ, net calorific value
water use	WDP	m^3 world equiv. deprived

The environmental impact indicators for the product are shown in Table 5.

Table 5: Environmental impacts per 1m^2 of 12-mm thick Kerrock solid surface for a period of 10 years in use

	Module	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	Total (A1-C4)
Abbrevation	Unit										
GWP-total	kg CO2 ekv.	6,24E+01	1,53E+00	4,61E+00	9,14E-01	0,00E+00	8,59E-02	0,00E+00	3,00E-01	-2,05E+00	6,98E+01
GWP-fossil	kg CO2 ekv.	6,60E+01	1,52E+00	1,60E+00	4,71E-01	0,00E+00	8,53E-02	0,00E+00	3,09E-01	-2,05E+00	7,00E+01
GWP-biogenic	kg CO2 ekv.	-3,71E+00	-1,81E-03	3,01E+00	4,43E-01	0,00E+00	-1,00E-04	0,00E+00	-8,96E-03	-5,08E-03	-2,66E-01
GWP-luluc	kg CO2 ekv.	4,86E-02	1,24E-02	7,91E-04	3,79E-04	0,00E+00	6,97E-04	0,00E+00	9,06E-04	-9,17E-04	6,37E-02
ODP	kg CFC 11 ekv.	8,04E-13	2,99E-16	1,70E-12	4,42E-15	0,00E+00	1,68E-17	0,00E+00	1,20E-15	-1,10E-13	2,51E-12
AP	mol H+ ekv.	1,73E-01	4,89E-03	4,65E-03	1,13E-03	0,00E+00	3,00E-04	0,00E+00	2,20E-03	-1,91E-03	1,86E-01
EP-freshwater	kg PO4 ekv.	1,07E-04	4,50E-06	3,44E-06	5,24E-04	0,00E+00	2,53E-07	0,00E+00	5,18E-07	-1,92E-06	6,39E-04
EP-marine	kg N ekv.	3,72E-02	2,24E-03	2,00E-03	2,28E-03	0,00E+00	1,39E-04	0,00E+00	5,70E-04	-5,14E-04	4,44E-02
EP-terrestrial	mol N ekv.	4,09E-01	2,50E-02	2,24E-02	3,47E-03	0,00E+00	1,55E-03	0,00E+00	6,27E-03	-5,49E-03	4,68E-01
POCP	kg NMVOC ekv.	1,36E-01	4,42E-03	5,17E-03	8,85E-04	0,00E+00	2,72E-04	0,00E+00	1,73E-03	-1,68E-03	1,48E-01
ADP-mirerals&	kg Sb ekv.	2,53E-05	1,34E-07	6,88E-08	6,05E-08	0,00E+00	7,56E-09	0,00E+00	2,91E-08	-5,54E-07	2,56E-05
ADP-fossil	MJ	1,52E+03	2,01E+01	4,86E+00	4,64E+00	0,00E+00	1,14E+00	0,00E+00	4,09E+00	-3,55E+01	1,56E+03
WDP	m3	-1,91E-01	1,41E-02	5,41E-01	2,00E-01	0,00E+00	7,91E-04	0,00E+00	3,31E-02	-1,10E-01	5,97E-01

5.2 Indicators of raw material use

The results of the raw materials use are in accordance with the standard EN 15804:2012+A2:2019, shown with ten indicators (Table 6). Indicators include the use of renewable and non-renewable energy, the use of renewable and non-renewable material resources and the use of water.

Table 6: Abbreviations and units of indicators of raw material use

Indicators of raw material use	Abbreviation	Unit
use of renewable primary energy, excluding raw material	PERE	MJ, net calorific value
use of renewable primary energy, including raw material	PERM	MJ, net calorific value
sharing of renewable primary energy	PERT	MJ, net calorific value
use of non-renewable primary energy, excluding raw materials	PENRE	MJ, net calorific value
use of non-renewable primary energy sources, including raw materials	PENRM	MJ, net calorific value
sharing of primary non-renewable energy	PENRT	MJ, net calorific value
use of secondary materials	SM	kg
use of renewable secondary fuels	RSF	MJ, net calorific value
use of non-renewable secondary fuels	NRSF	MJ, net calorific value
use fresh drinking water	FW	m^3

The indicators of the use of raw materials for the product are shown in Table 7.

Table 7: Raw material use per 1m^2 of 12-mm thick Kerrock solid surface for a period of 10 years

	Module	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	Total (A1-C4)
Abbrevation	Unit										
PERE	MJ	1,69E+02	1,16E+00	1,39E+00	1,42E+00	0,00E+00	6,54E-02	0,00E+00	5,51E-01	-4,63E+00	1,74E+02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,69E+02	1,16E+00	1,39E+00	1,42E+00	0,00E+00	6,54E-02	0,00E+00	5,51E-01	-4,63E+00	1,74E+02
PENRE	MJ	1,52E+03	2,03E+01	4,87E+00	4,64E+00	0,00E+00	1,14E+00	0,00E+00	4,10E+00	-3,55E+01	1,56E+03
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,52E+03	2,03E+01	4,87E+00	4,64E+00	0,00E+00	1,14E+00	0,00E+00	4,10E+00	-3,55E+01	1,56E+03
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-3,84E-01	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m3	2,38E-01	1,33E-03	1,41E-02	4,00E-03	0,00E+00	7,49E-05	0,00E+00	1,01E-03	-5,86E-03	2,59E-01

5.3 Other indicators of environmental impacts and output flow indicators

According to the standard EN 15804:2012+A2:2019, the results for other environmental information (waste disposal data) are presented with three indicators, and the results of the output flows from the system are based on four indicators (Table 8).

Table 8: *Abbreviations and units of other indicators of environmental impacts and of indicators describing output flows*

Indicators for other environmental information	Abbreviation	Units
disposal of hazardous waste	HWD	kg
disposal of non-hazardous waste	NHWD	kg
disposal of radioactive waste	RWD	kg
Output flow indicators	Abbreviation	Units
constituents suitable for re-use	CRU	kg
materials for recycling	MFR	kg
materials for renewable energy	MER	kg
energy emitted	EE	MJ on the energy carrier

Indicators for other environmental information and output flow indicators for the product are shown in Table 9.

Table 9: Other indicators of environmental impacts and indicators describing output flows per 1m² of 12-mm thick Kerrock solid surface for a period of 10 years of use

	Module	A1-A3	A4	A5	B	B1-B7	C2	C3	C4	D	Total (A1-C4)
Abbrevation	**Unit**										
HWD	kg	3,73E-07	1,07E-09	3,77E-08	9,75E-10	0,00E+00	6,01E-11	0,00E+00	4,35E-10	-9,18E-09	4,13E-07
NHWD	kg	1,37E+01	3,17E-03	5,26E+00	8,01E-01	0,00E+00	1,79E-04	0,00E+00	2,04E+01	-1,22E-02	4,01E+01
RWD	kg	2,49E-02	3,68E-05	1,27E-04	3,97E-04	0,00E+00	2,07E-06	0,00E+00	4,30E-05	-1,55E-03	2,55E-02
Abbrevation	**Unit**										
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	2,51E-01	0,00E+00	1,32E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,84E-01
MER	kg	0,00E+00	0,00E+00	2,60E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,60E+00
EE	MJ	0,00E+00	0,00E+00	2,50E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,50E+01

5.4 The indicators to describe the additional environmental impacts

According to the standard EN 15804:2012+A2:2019, the results for additional environmental impacts are presented with six indicators (Table 10). Additional environmental impacts evaluated for the product are shown in Table 11.

Table 10: *Abbreviations and units of additional environmental impact indicators*

Additional environmental impact indicators	Abbreviation	Units
particulate matter emissions	PM	disease incidence
ionizing radiation, human health	IRP	kBq U 235 eq.
eco-toxicity (freshwater)	ETP-fw	CTUe
human toxicity, cancer effects	HTP-c	CTUh
human toxicity, non-cancer effects	HTP-nc	CTUh
land use related impacts/soil quality	SQP	dimensionless

Table 11: Additional environmental impact indicators per 1m² of 12-mm thick Kerrock solid surface for a period of 10 years of use

	Module	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D	Total (A1-C4)
Abbrevation	**Unit**										
PM	disease incid.	1,98E-06	2,89E-08	2,51E-08	1,27E-08	0,00E+00	1,73E-09	0,00E+00	2,73E-08	-1,73E-08	2,08E-06
IRP	kBq U235 eq.	2,09E+00	5,37E-03	1,93E-02	6,26E-02	0,00E+00	3,02E-04	0,00E+00	4,52E-03	-2,52E-01	2,18E+00
ETP-fw	CTUe	5,79E+02	1,50E+01	2,00E+00	7,04E+01	0,00E+00	8,43E-01	0,00E+00	2,33E+00	-5,49E+00	6,70E+02
HTP-c	CTUh	3,78E-08	3,03E-10	2,46E-10	2,42E-09	0,00E+00	1,70E-11	0,00E+00	3,44E-10	-7,74E-10	4,11E-08
HTP-nc	CTUh	2,05E-06	1,79E-08	2,41E-08	2,49E-07	0,00E+00	1,02E-09	0,00E+00	3,80E-08	-1,33E-08	2,38E-06
SQP	Pt	8,44E+02	6,94E+00	7,11E+00	2,45E+00	0,00E+00	3,90E-01	0,00E+00	8,26E-01	-3,36E+00	8,61E+02

5.5 Impacts for different thickness and density of the Kerrock solid surfaces

Kerrock solid surfaces differ in thickness and density. Thicknesses can range between 6 mm and 27 mm and densities can range between 1680 and 1750 kg/m^3. In this EPD, the calculated impacts refer to the product with thickness 12 mm and density 1700 kg/m^3. To determine the impacts for products with different density and thickness, a conversion factor (A) shall be multiplied with each impact category value. The conversion factor (A) is calculated by:

$$A = \frac{\rho}{\rho_{ref}} * \frac{T}{T_{ref}}$$

Where:

ρ = commercialized density of Kerrock (in range of 1680-1750 kg/m^3)

ρ_{ref} = Kerrock solid surface with density of 1700 kg/m^3

T = commercialized thickness of Kerrock (in range of 6-27 mm)

T_{ref} = Kerrock solid surface with thickness of 12 mm

6 Interpretation of results

The product stage (i.e. modules A1-A3) contributes the most to the impact categories in life cycle of the Kerrock solid surface, the exceptions are impact on global warming - biogenic (GWP-biogenic), impact on eutrophication - aquatic freshwater (EP-freshwater), impact on ozone depletion (ODP) and impact on water use (WDP) (Figure 3). In latter case, the product stage yields benefit. The product stage contributes 89% of the total environmental impact in terms of global warming potential - total (GWP-total), 93% of the total environmental impact in terms of acidification (AP), 84% of the total environmental impact in terms of eutrophication of aquatic marine (EP-marine), 87% of the total environmental impact in terms of eutrophication terrestrial (EP-terrestrial), 92% of the total environmental impact in terms of photochemical ozone formation (POCP), 99% of the total environmental impact in terms of depletion of abiotic resources - minerals and metals (APD-minerals&metals) and 98% of the total environmental impact in terms of depletion of abiotic resources - fossil fuels (ADP-fossil) (Figure 3).

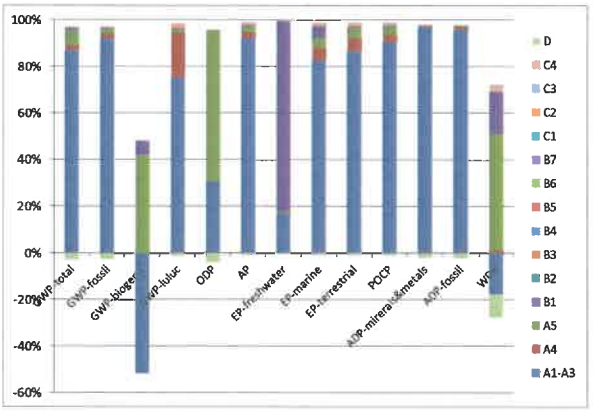

Figure 3: The relative contributions of different life cycle stages to the environmental impact of 1m^2 of 12-mm thick Kerrock solid surface for a period of 10 years of use

In case of impact on eutrophication - aquatic freshwater (EP-freshwater), the dominating process is cleaning of Kerrock solid surface with water and soap over ten years use (the module B1

– maintenance, as a part of use stage), contributing 82% of the total parameter value. The product stage contributes 17% of the total parameter value in terms of EP-freshwater (Figure 3).

The module A5 (installation in the building) represents 91% of the impacts affecting water use (WDP). The module A5 shows the greatest impact also to GWP-biogenic (contributing 87% of the impacts) and to ODP (contributing 68% of the impacts) (Figure 3). Such significant contributions of this module to WDP, GWP-biogenic and ODP are mostly related to treatment of wastes after product installation.

Contributors analysis

Methylmethacrylate is the raw material, which contributes the most to the environmental impacts in life cycle of Kerrock solid surface (Figure 4).

Methylmethacrylate represents 78% in terms of total parameter value of global warming (i.e. GWP-total). Aluminium trihydrate represents 9%, energy requirements related with electricity production 6% and direct emissions in Kerrock production process contribute 5% in terms of the total parameter value. The other raw, ancillary and packaging materials and other processes represent minor contributions, less than 2% each (Figure 4).

Results show that pigment paste contributes 42% of total ozone layer depletion (ODP) value in life cycle of the Kerrock solid surface, while methylmethacrylate contributes 37% to the total parameter value. The reason for high contribution of pigment paste on ODP value is inconsistency of models for evaluating ODP impacts in ecoinvent and Professional databases. Pigment paste production was modelled by use of datasets from ecoinvent database, due to lack of relevant datasets in Professional database.

Acidification (AP) and eutrophication (i.e. EP-freshwater, EP-marine and EP-terrestrial) are mainly caused by methylmethacrylate (59 to 66%), followed by aluminium trihydrate (contributing from 9% in case of EP-freshwater to 22% in case of EP-terrestrial). Electricity requirements in the process of manufacturing of Kerrock material and transport processes (delivery of raw materials and internal transport in the factory) also show notable contribution to AP, EP-freshwater, EP-marine and EP-terrestrial (Figure 4).

Photochemical ozone formation (POCP) is mostly affected by methylmethacrylate (50%). Contribution of aluminium trihydrate is 16%, while direct emissions in Kerrock solid surface production process contribute 19% to the total parameter value (Figure 4).

Depletion of abiotic resource - minerals and metals (ADP-m&m) is dominated by filters (ancillary materials), which contribute 42% of total impact on this parameter value. These filters are partly made from steel. While methylmethacrylate contributes 30% to the total parameter value (Figure 4).

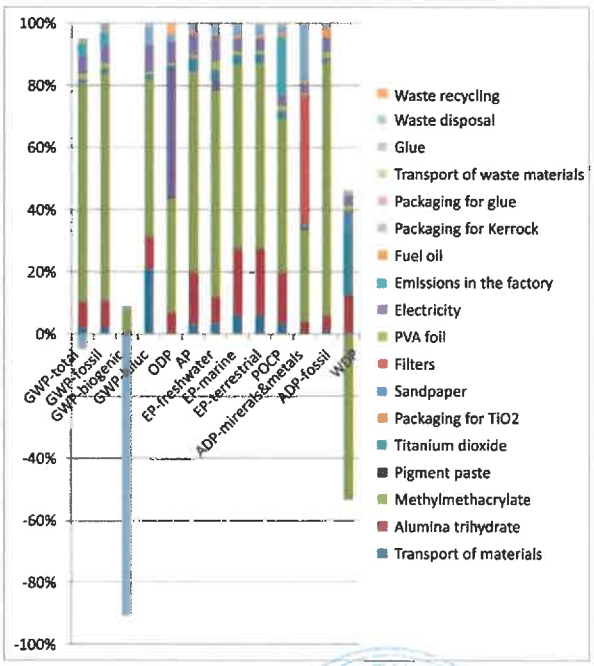

Figure 4: Contributors analysis for product stage of 1m² of 12-mm thick Kerrock solid surface

Depletion of abiotic resources - fossil fuels (ADP_fossil) is also mostly affected by methylmethacrylate (82%), followed by aluminium trihydrate (4.5%) and energy requirements related with electricity production (4.5%) (Figure 4).

In terms of water use (WDP), production of methylmethacrylate yields a benefit (i.e. water saving). This benefit is even higher than water use associated with production of other raw materials and with processes in the product stage (Figure 4).

7 Additional information

Additional scenarios are possible in the end-of-life stage. For example, discarded Kerrock products can be recycled into smaller products. Kerrock products with damaged surface can be restored by grinding the surface. The discarded Kerrock can be also incinerated.

8 References

1. GaBi (version 10.0) was applied to conduct LCA
2. EN 15804:2012+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
3. EN ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework (EN ISO 14040:2006)
4. EN ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines (EN ISO 14044:2006)
5. EN ISO 14025:2010 Environmental labels and declarations - Type III environmental
6. Product Category Rules for Building-Related Products and Services - Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019, version 1.0. Institut Bauen und Umwelt e.V.
7. Product Category Rules (PCR) Part B: Requirements on the EPD for Sanitary products made from composite materials. Institut Bauen und Umwelt e.V.

The data specified in the EPD are calculated on the basis of the data provided by the manufacturer. In the event that the manufacturer's information is incorrect, calculations do not apply.