# Environmental Product Declaration

*according to ISO 14025 and EN 15804*

This declaration is for:
**Super Neopal Eco**

Provided by:
**Vivechrom SA**



program operator
**Stichting MRPI®**
publisher
**Stichting MRPI®**
**www.mrpi.nl**

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**1.1.00237.2021**
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expiry date
**12-10-2026**

## COMPANY INFORMATION

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*https://www.vivechrom.gr*

## PRODUCT

Super Neopal Eco

## DECLARED UNIT/FUNCTIONAL UNIT

All impacts are calculated using the declared unit "decoration of 1 m² of surface"

## DESCRIPTION OF PRODUCT

Super premium quality ecological matt emulsion paint for interior use on walls and ceilings.

## VISUAL PRODUCT


## MRPI® REGISTRATION

1.1.00237.2021

## DATE OF ISSUE

12-10-2021

## EXPIRY DATE

12-10-2026

## MORE INFORMATION

*https://www.vivechrom.gr/en/products-listing/super-neopal-eco*

## SCOPE OF DECLARATION

This MRPI®-EPD certificate is verified by **ing. Kamiel Jansen, Primum.**
The LCA study has been done by **Joanna Zhuravlova & Brienne Wiersema, Ecomatters.**
The certificate is based on an LCA-dossier according to ISO14025 and EN15804+A1. It is verified according to the 'MRPI®-EPD verification protocol November 2020.v4.0'. EPDs of construction products may not be comparable if they do not comply with EN15804+A1. Declaration of SVHC that are listed on the 'Candidate List of Substances of Very High Concern for authorisation' when content exceeds the limits for registration with ECHA.

## PROGRAM OPERATOR

Stichting MRPI®
Kingsfordweg 151
1043GR
Amsterdam

ir. J-P den Hollander, Managing director MRPI®

| *DEMONSTRATION OF VERIFICATION* |
|---|
| CEN standard EN15804 serves as the core PCR[a] |
| Independent verification of the declaration and data, according to EN ISO 14025:2010: internal: external: X |
| Third party verifier: Kamiel Jansen, Primum |
| [a] PCR = Product Category Rules |

## DETAILED PRODUCT DESCRIPTION

This EPD is representative for the product paints belonging to the Super Neopal ECO product:

- Super Neopal ECO White
- Super Neopal ECO Base P (light)
- Super Neopal ECO Base D (medium)
- Super Neopal ECO Base TR (transparent)

Super Neopal ECO is a super-premium quality ecological matt emulsion paint for interior use that contributes to a better indoor air quality (low emission test report is available for French VOC Regulation A+) and is ideal for all interior areas. It is certified by AFNOR and fulfills the criteria of the European Union Eco-Label Board. It is ammonia free and does not contain dangerous substances, such as heavy metals, free formaldehyde, aromatic hydrocarbons. It has great hiding power and spreading rates, superior whiteness and vivid shades with long lasting color stability and with outstanding resistance to frequent washing (class 1 EN 13300). It is easy to apply, has strong adhesion, is quick drying and can cover with two coats any painted surface. It has great leveling properties and provides a beautiful mat finish.

Typical use: Suitable for interior use on all standard masonry interior wall and ceiling surfaces. It is suitable for plaster, gypsumboards, concrete, bricks, and wood.

Application method: Applied with brush, roller or airless spray. Apply the paint and let it dry at temperatures between 10°C to 35°C

Pack size: The products are packed in a packaging with a capacity of 1L, 3L or 10L.

Production process and conditions of delivery:
During paint production, the raw materials are pre-weighed according to the percentage of each in the formulation. The pigment is then dispersed in a mixture of binder and solvent using a variety of machines. The amount and type of dispersion is product specific and depends on the type of finish required. Finally, tinter is added to correct the color, the paint is thinned to viscosity, filtered and filled into the appropriate packaging container. All paint containers are transported from the production sites to customers in Greece, Cyprus, Albania and Bulgaria.

| COMPONENT (> 1%) | [kg / %] |
|---|---|
| Binder: Acrylic copolymer dispersion | Confidential |
| Solvent: Water | Confidential |
| Pigment: Lightfast pigments | Confidential |
| Filler | Confidential |

**(*) > 1% of total mass**

## SCOPE AND TYPE

The type of this EPD is Cradle-to-Gate with options. All major steps from the extraction of natural resources to the final disposal of the product are included in the environmental performance of the manufacturing phase, except those that are not relevant to the environmental performance of the product. This declaration does not imply an indicator result of zero. This EPD is representative for products produced in Elefsis, Greece and the application market is for Greece, Albania, Cyprus and Bulgaria.

The software GaBi 10.0.0.92 Professional was used to perform the LCA. In the model the data used is sourced from the Ecoinvent 3.7 database and the Raw materials LCI database for the European Council of the Paint, Printing Ink and Artists' Colours Industry (CEPE).

The validity of this EPD is in correspondence with the specifications of the LCA project report.

All impacts associated with the upstream production of materials and energy are included in the system boundaries. Mining activities and controlled landfills are included in the product systems. Similarly, wastewater treatment activities are also considered within the technological systems. The emissions and resource extractions derived from these processes are considered elementary exchanges between the product systems and the environment.

| PRODUCT STAGE | | | CONSTRUCTION PROCESS STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | | BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material supply | Transport | Manufacturing | Transport gate to site | Assembly | 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 | X | X | X | X | X | X | X | X | X | X | ND |

X = Modules Assessed

ND = Not Declared

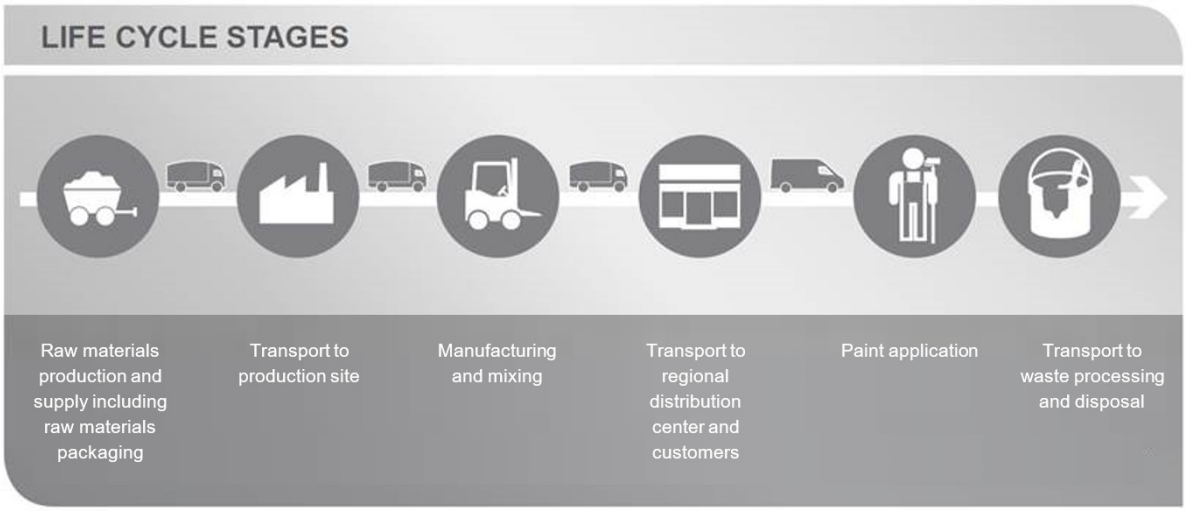


*Figure: LCA process diagram according to EN 15804 (7.2.1)*

## REPRESENTATIVENESS

The representative product consists of a weighted average based on annual production volumes of the formulation and characteristics (i.e. packaging format) of the 4 products within the Super Neopal Eco:

- *Super Neopal Eco White*
- Super Neopal Eco Base P (light)
- Super Neopal Eco Base D (medium)
- Super Neopal Eco Base TR (transparent)

This EPD is representative for products produced in Greece. The paint is produced at one production site: Elefsis, Greece.

*VIVECHROM SUPER NEOPAL ECO*
Density (kg/l) 1.415
Coverage (m²/l) 14
Number of Layers 2
Total product used (kg/m²) 0.202

A sensitivity analysis is performed to assess the representativeness of the representative product. The environmental impact results for the individual Super Neopal Eco products have maximum positive difference of 33% (Super Neopal Eco Base TR) when compared with the representative product, in the Ozone Layer Depletion Potential (ODP, steady state) impact category.

## ENVIRONMENTAL IMPACT per functional unit or declared unit (indicators A1)

| | UNIT | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ADPE | kg Sb. eq. | 1.95 E-6 | 1.34 E-8 | 1.88 E-7 | 2.16 E-6 | 6.32 E-8 | 7.18 E-9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.42 E-9 | 0.00 | 3.98 E-9 |
| ADPF | MJ | 7.91 E+0 | 8.65 E-2 | 1.86 E+0 | 9.86 E+0 | 2.98 E-1 | 3.40 E-2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.81 E-2 | 0.00 | 3.11 E-2 |
| GWP | kg CO2 eq. | 4.20 E-1 | 5.57 E-3 | 8.66 E-2 | 5.12 E-1 | 1.96 E-2 | 1.52 E-1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.80 E-3 | 0.00 | 5.91 E-2 |
| ODP | kg CFC 11 eq. | 3.71 E-7 | 1.01 E-9 | 1.64 E-9 | 3.73 E-7 | 3.47 E-9 | 3.35 E-10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.40 E-10 | 0.00 | 3.49 E-10 |
| POCP | kg ethene eq. | 2.41 E-4 | 2.28 E-6 | 3.38 E-5 | 2.77 E-4 | 7.55 E-6 | 1.35 E-4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.44 E-7 | 0.00 | 1.00 E-6 |
| AP | kg SO2 eq. | 5.37 E-3 | 2.19 E-5 | 2.95 E-4 | 5.69 E-3 | 7.70 E-5 | 2.13 E-5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.99 E-6 | 0.00 | 1.03 E-5 |
| EP | kg (PO4)3- eq. | 6.99 E-4 | 6.52 E-6 | 5.77 E-5 | 7.63 E-4 | 2.30 E-5 | 3.34 E-3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.07 E-6 | 0.00 | 1.09 E-5 |

ADPE = Abiotic Depletion Potential for non-fossil resources
ADPF = Abiotic Depletion Potential for fossil resources
GWP = Global Warming Potential
ODP = Depletion potential of the stratospheric ozone layer
POCP = Formation potential of tropospheric ozone photochemical oxidants
AP = Acidification Potential of land and water
EP = Eutrophication Potential
ND = Not Declared

## RESOURCE USE per functional unit or declared unit (A1 / A2)

| | UNIT | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 2.50 E-1 | 9.40 E-4 | 7.04 E-2 | 3.21 E-1 | 3.33 E-3 | 5.07 E-4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.49 E-4 | 0.00 | 3.45 E-4 |
| PERM | MJ | 1.66 E-4 | 5.26 E-10 | 7.39 E-3 | 7.56 E-3 | 2.24 E-9 | 2.74 E-10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.71 E-10 | 0.00 | 6.12 E-10 |
| PERT | MJ | 2.50 E-1 | 9.40 E-4 | 7.78 E-2 | 3.29 E-1 | 3.33 E-3 | 5.07 E-4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.49 E-4 | 0.00 | 3.45 E-4 |
| PENRE | MJ | 8.46 E+0 | 8.77 E-2 | 1.98 E+0 | 1.05 E+1 | 3.02 E-1 | 3.46 E-2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.86 E-2 | 0.00 | 3.16 E-2 |
| PENRM | MJ | 3.59 E-6 | 0.00 | 8.61 E-8 | 3.67 E-6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PENRT | MJ | 8.47 E+0 | 8.77 E-2 | 1.98 E+0 | 1.05 E+1 | 3.02 E-1 | 3.46 E-2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.86 E-2 | 0.00 | 3.16 E-2 |
| SM | kg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RSF | MJ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FW | m3 | 2.60 E-1 | 7.45 E-4 | 3.46 E-5 | 2.61 E-1 | 1.18 E-5 | 3.31 E-6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.25 E-5 | 0.00 | 2.57 E-1 |

PERE = Use of renewable energy excluding renewable primary energy resources
PERM = Use of renewable energy resources used as raw materials
PERT = Total use of renewable primary energy resources
PENRE = Use of non-renewable primary energy resources excluding non-renewable 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 materials
RSF = Use of renewable secondary fuels
NRSF = Use of non renewable secondary fuels
FW = Use of net fresh water
ND = Not Declared

## OUTPUT FLOWS AND WASTE CATEGORIES per functional unit or declared unit (A1 / A2)

| | UNIT | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | kg | 0.00 | 0.00 | 4.38 E-3 | 4.38 E-3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NHWD | kg | 0.00 | 0.00 | 4.14 E-3 | 4.14 E-3 | 0.00 | 1.13 E-1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.02 E-1 |
| RWD | kg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CRU | kg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MFR | kg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MER | kg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EEE | MJ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ETE | MJ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

HWD = Hazardous Waste Disposed
NHWD = Non Hazardous Waste Disposed
RWD = Radioactive Waste Disposed
CRU = Components for reuse
MFR = Materials for recycling
MER = Materials for energy recovery
EEE = Exported Electrical Energy
ETE = Exported Thermal Energy
ND = Not Declared

## CALCULATION RULES

*Cut off criteria*

The cut-off is not considered in any of the life cycle stages.

In the electricity for paint manufacturing process, transmission and transformation losses were not accounted for in case of renewable energy sources (wind energy). The reason for that exclusion is the fact that transformation and transmission losses account together for less than 1% of the energy input and it is not expected to influence the results significantly.

*Data quality and data collection period*

Specific data was collected from AkzoNobel though a questionnaire, including inquiries about paint characteristics, production information and end-of-life. The data collection period for specific data was the year 2020.

Transport data (for raw materials, paint and packaging materials), packaging materials use and packaging material end of life scenarios were covered with data generic values as described in the Product Environmental Footprint Category Rules - Decorative Paints document version 1.0 published by CEPE and reviewed in April 2018. Further data gaps (i.e. end-of-life transport data) were covered with data from internal AkzoNobel LCA studies concerning the same type of products (paints and coatings). Generic data (i.e. upstream acquisition and production of raw materials, energy generation, transport, waste treatment processes) was selected from Ecoinvent 3.7 database. In the case of missing data, a relevant proxy was searched and adjusted to the corresponding unit process.

*Allocation procedure*

To allocate the emissions and inputs to the manufactured products, the decision-hierarchy in ISO 14044 is used (ISO 2006). It is not possible to sub-divide the site data into a more detailed level or find physical causalities between inputs and outputs, thus allocation is done based on mass, considering the annual production of paint product for each site. The paint production is basically a process of mixing ingredients and, therefore, the environmental impact is fairly to be related to the mass of the products.

## SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

*A1. Raw materials supply*

This module considers the extraction and processing of all raw materials and energy which occur upstream to the Vivechrom Wallpaints manufacturing process, as well as waste processing up to the end-of waste state.

*A2. Transport of raw materials to manufacturer*

This includes the transport distance of the raw materials to the manufacturing facility via road. Based on Product Environmental Footprint Category Rules - Decorative Paints the transport characteristics for this life cycle stage are the following:

| Raw materials transport type | Truck 1 |
|---|---|
| Distance (km) | 460 |
| Capacity | 34-40 t ,60% payload |
| Bulk density of transported products | 1441 kg/m3 |

*A3. Manufacturing*

This module covers the manufacturing of the Super Neopal Eco paint and includes all processes linked to production such as storing, mixing, packing and internal transportation. Use of electricity, fuels and auxiliary materials in paint production is taken into account as well.

Data regarding paint production was provided for the manufacturing site where the Super Neopal Eco paints are produced: Elefsis, Greece. Furthermore, the specific transportation distances and transportation modes for raw materials, paint packaging and transportation to customer were collected from the AkzoNobel logistics department. Primary data and site-specific data were retrieved. For electricity sources, Ecoinvent 3.7 dataset was used. For upstream (raw material processes) and downstream processes (application, use, and waste processing) generic data is used when no specific data is obtained.

The construction site data includes lighting, heating, offices, etc. The manufacture of production equipment and infrastructure is not included in the system boundary.

*A4. Transport to Regional Distribution Centre and customer*

All paint containers are transported from the production facility into a distribution centre and then finally to the customer. On average, the transport characteristics for this life cycle stage are the following:

| Transport from factory to RDC | Transport from factory to RDC | Transport from RDC to customer |
|---|---|---|
| Vehicle type | Truck 1 | Truck 2 |
| Distance | 350 | 370 |
| Capacity utilisation | 34-40 t ,60% payload | 34-40 t ,60% payload |
| Bulk density of transported products | 1441 kg/m3 | 1441 kg/m3 |

*A5. Application and use*

This module includes the environmental aspects and impacts associated with the application and of the paint. It is assumed that no energy is required during the application of this paint. The use of paintbrushes and other appliances used during application are not included. There are some raw materials added in the paint formulations which contain small amounts of solvents. The VOC emissions during application of paint are included in this module.

*C2. Transport to incineration or landfill*

This module includes one-way transportation distance of the demolition or sorting site to the dump site.

| End-of-life transport type | Transport to waste processing |
|---|---|
| Vehicle type | 34-40 t ,60% payload |
| Distance | 100 km |
| Capacity utilisation | 60% |
| Bulk density of transported products | 1441 kg/m3 |

*C3. Waste processing and C4. Disposal*

The end of life stage is encompassed in these modules. It is assumed that paint is used as interior paint. It is assumed that part of the paint is lost during application and the rest is applied.

The coating lost during application is assumed to be non-hazardous waste and disposed of in landfill (35%) and incinerated (65%). After its lifetime, it is assumed that part of the coatings end up in landfill (88%) and in incineration (12%) as non-hazardous waste. These assumptions are based on best knowledge of the end of life of coating from direct contact with AkzoNobel.

| Classification of paint, based on function | % Sold paint in walls > 100 years | % of sold paint to landfill | % of sold paint to incineration |
|---|---|---|---|
| Interior Masonry Wall | 0,0 | 88,0% | 12,0% |
| Exterior, Trim and other paints | 0,0% | 88,0% | 12,0% |

*ADDITIONAL INFORMATION ON ENVIRONMENTAL IMPACTS*

LEED & BREEAM compliance.

The product has been tested by Eurofins regarding VOC and sVOC emissions and provided relevant attestations for LEED v4 and v4.1 as also relevant BREEAM compliance. The same Eurofins report confirms the compliance with the EUROFINS Air Comfort Gold Certification.

*"Unspecified VOC" emissions*

The CML-IA methods do not have characterization factors for the “unspecified VOC” emission flow in the Global Warming Potential environmental impact category. However, VOCs are known to have influence in this category. In order to include the impacts of the VOCs and align with current practice of AkzoNobel, it was decided to calculate the VOC impact on Global Warming Potential separately. The Global Warming Potential impact category has been modified, adding a generic factor of 4.23 kgCO2-eq/kg VOC, which is in line with AkzoNobel characterisation factors for carbon reporting.

| Environmental Impact | UNIT | A1 | A2 | A3 | TOTAL A1-A3 | A4 | A5 | C2 | C4 |
|---|---|---|---|---|---|---|---|---|---|
| Global Warming potential (GWP 100 years) | [kg CO2-Eq.] | 4.20E-1 | 5.57E-3 | 8.66E-2 | 5.12E-1 | 1.96E-2 | 1.52E-1 | 1.80E-3 | 5.91E-2 |
| GWP 100 years incl. VOC char. fact. | [kg CO2-Eq.] | 4.20E-1 | 5.57E-3 | 8.66E-2 | 5.12E-1 | 1.96E-2 | 1.54E-1 | 1.80E-3 | 5.91E-2 |

## DECLARATION OF SVHC

None of the substances contained in the product are listed in the “Candidate List of Substances of Very High Concern for authorisation”, or they do not exceed the threshold with the European Chemicals Agency.

## REFERENCES

EN 15804:2012+A1:2013 Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products, of 11/2013.

• ISO 14040/14044 on Life Cycle Assessments

• Product Environmental Footprint Category Rules - Decorative Paints version 1.0, 2018. Developed by the Technical Secretariat Decorative Paints of the European Council of the Paint, Printing Ink and Artists' Colours Industry.

• Coenen, J., Personal communication with Job Coenen, Business Development Manager Sustainability, 2021.

• GaBi Software-System and Database for Life Cycle Engineering. Copyright 1992-2021.Sphera Solutions GmbH

• Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8> [Accessed 20-03-2021]

## REMARKS

None