

Owner of declaration:	HEVADEX Group
Publisher:	Kiwa-Ecobility Experts
Program operator:	Kiwa-Ecobility Experts
Declaration number:	EPD-Hevadex-202-EN
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Valid until:	29.11.2027



Omniguard 110NP

This Environmental Product Declaration (EPD) is based on the Life Cycle Assessment (LCA) of the waterborn coating Omniguard 110NP by HEVADEX Group.

1. General information

HEVADEX Group

Program operator:
 Kiwa-Ecobility Experts
 Voltastr. 5
 13355 Berlin
 Germany

Declaration number
 EPD-Hevadex-202-EN

Product category rules
 PCR A: Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules, Version 2.1, 2022-02-04
 PCR B: Requirements for Environmental Product Declarations for coatings, Edition 2022-03-07 (draft)

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 (Head of Kiwa-Ecobility Experts)



Prof. Dr. Frank Heimbecher
 (Chairman of the independent expert committee Kiwa-Ecobility Experts)

Omniguard 110NP

Owner of declaration:
 HEVADEX Group
 Spinnerlaan 6
 9160 Lokeren
 Belgium

Declared product / declared unit
 1 m²

Scope
 The declaration is valid for 1 m² of the waterborn coating “Omniguard 110NP” produced by HEVADEX Group in Lokeren, Belgium. The indicative consumption is 0.6 kg/m². The used geographical area is Belgium.

The owner of the declaration shall be liable for the underlying information and evidence. Kiwa-Ecobility Experts shall not be liable with respect to manufacturer information, lifecycle assessment data and evidence. The EPD was created according to the specifications. EPD of construction products may not be comparable if they do not comply with EN 15804.

Verification:
 The CEN standard EN 15804:2012+A2:2019 serves as the core PCR.
 Independent verification of the declaration and data according to ISO 14025:2010.
 internal external



Max Sonnen
 (Independent verifier of Ecomatters)

2. Product details

2.1 Product description

Omniguard 110NP, which is shown in Figure 1, is a waterborn, ready-to-use liquid based on state of the art polymer technology. This liquid is spray applied and dries to a peelable, light-transparent colourless film. It is produced at the production site by HEVADEX in Lokeren, Belgium.



Figure 1: OMNIGUARD 110NP

2.2 Application

Omniguard 110NP protects windows and concrete surfaces against damages and pollutions that occur during construction works. OMNIGUARD 110NP protection film can stay on the protected surface for up to 18 months (windows) and concrete (12 months). When construction works are finished, the protective film is easily removed and does not leave any residue. Suitable for inside and outside use.

2.3 Technical data

In Table 1 the technical data of OMNIGUARD 110NP are listed.

Table 1: Technical specifications

Parameter	Value	Unit
Indicative consumption	0.6	kg/m ²
Density	0.95	kg/L

2.4 Application & Placing on the market

Consult the safety data sheet prior to application. Requested to wear eye/face protection, mouth mask, gloves and safety wear.

Prior to starting the application:

- Perform a trial with a paintbrush; remove and evaluate the surface for suitability and for possible colour (f.e. concrete) or gloss differences (f.e. glossy aluminium window profiles).
- Apply vaseline or wax with a cloth on the rubber/silicone gaskets.
- When applying OMNIGUARD 110NP on concrete surfaces: allow at least 24 hours after formwork is removed; then apply hydrophobic pretreatment on the concrete surface with the Hevadex product BETOSHIELD WB, unless the concrete surface is already hydrophobic: BETOSHIELD WB is vaporized at 0,1 to 0,15 litre/m² on the (dry)concrete surface. OMNIGUARD 110NP is then applied at least 2 hours later. Only for use on polished/smooth concrete surfaces.

Application:

- Stirr OMNIGUARD 110NP for homogenisation (do not add solvents or water).
- Requirements during application and drying: temperature: 5 - 30°C; apply on a dry surface; do not apply during rain, or when rain or frost is expected the next 24 hours.
- OMNIGUARD 110NP is sprayed with an airless spray device at 100 to 150 bar pressure, and with a spraytip opening of between 0,015 and 0,023 inch.
- Total minimum consumption of OMNIGUARD 110NP as to guarantee easy peelability and protection:
 - Windows: 0,6kg/m² or ~600 micron or 0,5kg/m² on large glass surfaces
 - (Smooth/polished) concrete surfaces: 0,9kg/m² or ~900 micron (~0,9kg/m²)
 - Verify layer thickness with a wet film gauge. Do not apply more than 1,5kg/m².
- To speed the drying time and to avoid pinholes on concrete surfaces, apply in two passes, the second pass shortly after and crosswise over the first pass.
- Avoid overspray on adjacent surfaces by protecting these during application.
- Depending on conditions such as temperature, the film is tack free within 4 to 8 hours after application, and the total drying time is between 12 and 48 hours during which the film may not come in contact with rain or any other form of water, nor with temperatures < 5°C.
- During application, keep the pail under the airless closed to avoid skin formation.
- In case of inside application, allow ventilation.
- Cleaning material: after use with water.

Remove OMNIGUARD protection film:

- Windows with OMNIGUARD 110NP @ 0,6kg/m²: within 12 months
- Windows with OMNIGUARD 110NP @ 0,8kg/m²: within 18 months
- Concrete surfaces with OMNIGUARD 110NP @ 0,9 kg/m²: within 12 months

In Table 2 are the product certifications listed.

Table 2: Product certifications

Test institute	Test	Standard	Value	Report
SHR	UV resistance and natural ageing	EN ISO 16474-3:2013 – 400H.	Pass	17.0432-1 17/10/2017
Bureau Veritas	System evaluation	VERITAS	Pass	BV.AVS.4.12.14127A T-01 – 30/11/2021
	Absence of micropores	Aanalysis x4, x7, x10	Pass	BV.AVS.4.21.14012 AT-2 – 27/01/2021
SGS	Resistance to sparks of grinding and welding	SGS TEST PROGRAMM	Pass	204624B – 04/02/2021
Univerité de Liège	Traction	NBN EN ISO 527-3 (2019)	6,4 N/mm ²	LMC/21/008 – 20/01/2021
	Elongation	NBN EN ISO 527-3 (2019)	122 %	LMC/21/008 – 20/01/2021
	Hardness Shore A	ISO 7619-1 (2010)	87	AU-20-10 – 06/10/2020
	Hardness Shore D	ISO 7619-1 (2010)	49	AU-20-10 – 06/10/2020
CAI ULIÈGE	VOC content	ISO 11890-2	Pass	

2.5 Base materials / Ancillary materials

In Table 3 the main raw materials and their mass-percentages are listed.

Table 3: Raw materials and proportions in mass percent

Raw material	Proportion [m%]
Water	ca. 50
Polymers	ca. 40
Others (defoaming agent, repellent etc.)	ca. 10

2.6 Manufacturing

The manufacturing takes place at the production site of HEVADEX Group in Lokeren, Belgium. The manufacturing process is dispersion mixing. Measured waste during production is 0.5 %. No emissions during production. A simple flow diagram can be seen in Figure 2.

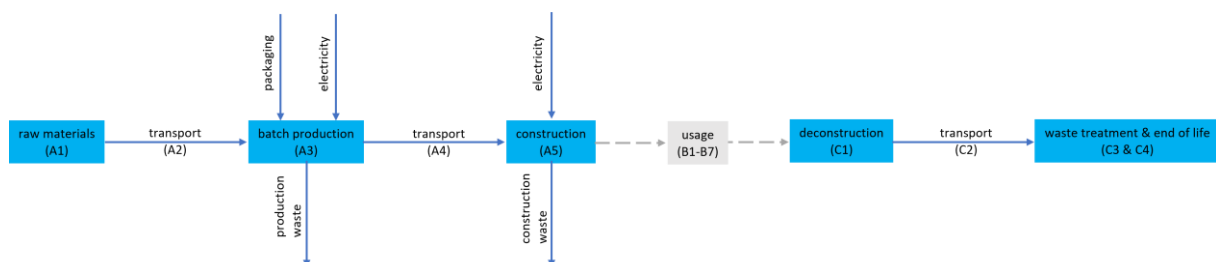


Figure 2: Simple flow diagram

2.7 Reference service life (RSL)

According to the manufacturer the reference service life (RSL) is 18 months for windows and 12 months for concrete. Since the use phase is not part of this EPD, the RSL is not considered.

2.8 Packaging

As can be seen in Figure 1, the packaging is a plastic bucket, which consists of 100 % recycled polypropylene.

3. LCA: Calculation rules

3.1 Declared unit

According to the PCR B “Requirements for Environmental Product Declarations for coatings, Edition 2022-03-07 (draft)” the declared unit is 1 m² coating.

Parameter	Value	Unit
Declared unit	1	m ²
Conversion factor to 1 kg	0.6	kg/m ²

3.2 System boundaries

This EPD was created in accordance with DIN EN 15804 and monitors the production, the construction and the end-of-life stage as well as the benefits and loads beyond the system boundary. According to DIN EN 15804 this corresponds to the product phases A1-A3, A4-A5, C1-C4 and D. Therefore, the type of the EPD is “cradle to gate with options”.

The modules include:

- A1: Extraction and processing of the raw materials (Polymer etc.)
- A2: Transport of the raw materials to the production site by the suppliers
- A3: Manufacturing of the coating (dispersion mixing) including electricity
- A4: Average transport distance to the application location with a truck
- A5: Application with airless spray machine
- C1: For the deconstruction no electric tools are needed, only physical work
- C2: Transport to the waste treatment plants according to the NMD waste scenarios
- C3: Percentages of the waste treatments according to the NMD waste scenarios
- C4: Disposal of the coating at the end of life
- D: Loads and benefits due to incineration and recycling

3.3 Assumptions and estimates

For most input data, such as the raw materials and supplier information, the values were provided by the manufacturer HEVADEX.

The used production electricity amount per m² coating is based on the following estimation: production machine uses 37 kWh; a batch production of 900 kg lasts for about an hour (total machine working time); the machine is not at full force but working at 40 % capacity; so 37 kWh divided by 900 kg and multiplied by 0,6 kg/m² and 40 %.

The polymers are biocide free (final product Omniguard 110NP contains biocide) and prepared from recycled materials. For polymers an EN 15804 compliant EPD data was available from suppliers and used.

HEVADEX uses 100 % green energy for the production, provided by Luminus with the contract “Luminus #BeGreen.pro Fix”. It consists of 79.7 % wind power onshore, 8.6 % biogas, 5.8 % biomass, 5.4 % wind power offshore and 0.5 % hydropower [VREG, 2022].

For the construction A5 an airless spray machine (220 V and 7.5 A) is used. On average 60 m² can be covered per hour. So 0.0275 kWh electricity are used per declared unit (1 m²). Here the average grid mix for Belgium was considered.

The best fitting waste scenarios were selected for the different materials. The waste scenarios are based on the “Nationale Milieudatabase” (NMD), the National Environmental Database of the Netherlands. Therefore, the Dutch electricity grid mix of 2019 is used for the energy recovery in module D.

This is due the fact that the used EPD & LCA tool R<THiNK is developed by NIBE in the Netherlands. The used waste scenarios were adjusted for Belgium.

Due to privacy reasons, more details are only included in the background report of this EPD.

3.4 Period under review

All process-specific data was collected for the operating year 2021. The quantities of raw and auxiliary materials have been recorded and averaged over the entire operating year. The energy consumption was calculated with the help of the usage time, the capacity and electricity consumption details of the machines.

3.5 Cut-off criteria

For process modules A1 to A3, all process-specific data was collected. All flows could be assigned potential environmental impacts through the Ecoinvent database 3.6. Production, supply, disposal, maintenance and end-of-life treatment of HEVADEX capital goods are included, but in the used Ecoinvent database 3.6 infrastructure and capital goods are included. All flows that contribute more than 1% of the total mass, energy or environmental impact of the system have been included in the LCA. It can be assumed that the neglected processes contributed less than 5% to the impact categories considered. It is assumed that the contribution of capital goods to each individual environmental impact category of the module (A1-A3) is less than 5%.

3.6 Data quality

Overall, the quality of the data can be considered as good. In the operating data survey, all relevant process-specific data were collected by the manufacturer HEVADEX.

Secondary data were taken from the Ecoinvent database version 3.6 (2019). The database is regularly checked and thus complies with the requirements of DIN EN ISO 14044 (background data not older than 10 years). The background data meets the requirements of EN 15804. The quantities of raw materials, consumables and supplies used as well as the energy consumption have been recorded and averaged over the entire year of operation.

The general rule has been complied that specific data from specific production processes or average data derived from specific processes must be given priority when calculating an EPD or Life Cycle Assessment. Data for processes that the manufacturer cannot influence or choose, were backed up with generic data.

The selection of the best fitting data sets is based on research and the help of experts. The transport distances for the waste treatments as well as the used environmental profiles for loads and benefits are based on the data from the NMD.

3.7 Allocations

Specific information about allocations within the background data is included in the documentation of the Ecoinvent datasets. There are no allocations during the manufacturing phase at the plant.

3.8 Comparability

In principle, a comparison or assessment of the environmental impact of different products is only possible if they have been produced in accordance with EN 15804. For the assessment of comparability, the following aspects in particular must be taken into account: PCR used, functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for the use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period).

4. LCA: scenarios and further technical information

No scenarios were analysed in this EPD.

5. LCA: Results

The following tables show the results of the life cycle assessment, more precisely for the environmental impact indicators, resource consumption, output flows and waste categories. The results presented here refer to the declared unit of 1 m².

The results of the environmental impact indicators ETPfw-, HTP-c, HTP-nc, SQP, ADP-f, ADP-mm and WDP must be used with caution, as the uncertainties in these results are high or there is limited experience with the indicator.

The IRP impact category mainly addresses the potential effect of low dose ionising radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposure, nor does it consider the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.

The mass of biogenic carbon containing materials in the product and the packaging is less than 5 % of the mass of the product and therefore the declaration can be omitted according to DIN EN 15804.

Specification of the system boundaries (X = module declared; - = module not declared)																
PRODUCTION PHASE			CONSTRUCTION PHASE		USE PHASE							DISPOSAL PHASE				Credits and loads outside the system boundaries
Raw material supply	Transport	Production	Transport	Construction / Installation	Use	Maintenance	Repair	Replacement	Conversion / Renewal	Operational energy use	Operational water use	Demolition	Transport	Waste treatment	Landfill	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

Table 1: Results of the LCA – Environmental impact indicators: Omniguard 110NP (1 m²)

Indicator (Impact category)	Unit	A1	A2	A3	A4	A5	C1	C2	C3	C4	D
AP	mol H+ eqv.	3,55E-03	3,42E-05	2,78E-04	5,55E-05	7,56E-04	0,00E+00	6,76E-05	6,95E-04	0,00E+00	-5,36E-05
GWP-total	kg CO2 eqv.	8,17E-01	6,60E-03	6,89E-02	9,58E-03	4,56E-01	0,00E+00	1,17E-02	1,50E+00	0,00E+00	-4,45E-02
GWP-b	kg CO2 eqv.	4,60E-02	4,63E-06	1,55E-03	4,42E-06	7,27E-03	0,00E+00	5,38E-06	1,81E-04	0,00E+00	-2,53E-04
GWP-f	kg CO2 eqv.	7,70E-01	6,59E-03	6,73E-02	9,57E-03	4,49E-01	0,00E+00	1,16E-02	1,50E+00	0,00E+00	-4,42E-02
GWP-luluc	kg CO2 eqv.	7,32E-04	1,99E-06	8,37E-05	3,51E-06	1,66E-04	0,00E+00	4,27E-06	1,26E-04	0,00E+00	-3,99E-05
ETP-fw	CTUe	6,93E+01	8,30E-02	1,26E+00	1,29E-01	1,47E+01	0,00E+00	1,57E-01	1,88E+01	0,00E+00	-2,20E-01
PM	disease incidence	3,06E-08	6,11E-10	1,98E-09	8,61E-10	6,51E-09	0,00E+00	1,05E-09	5,84E-09	0,00E+00	-2,21E-10
EP-m	kg N eqv.	6,80E-04	1,17E-05	5,03E-05	1,96E-05	1,59E-04	0,00E+00	2,38E-05	1,90E-04	0,00E+00	-1,41E-05
EP-fw	kg PO4 eqv.	1,62E-05	5,24E-08	3,39E-06	9,65E-08	4,11E-06	0,00E+00	1,17E-07	4,62E-06	0,00E+00	-3,88E-07
EP-T	mol N eqv.	8,75E-03	1,29E-04	5,95E-04	2,16E-04	1,96E-03	0,00E+00	2,62E-04	2,11E-03	0,00E+00	-1,64E-04
HTP-c	CTUh	1,93E-09	2,12E-12	4,36E-11	4,17E-12	3,61E-10	0,00E+00	5,08E-12	2,94E-10	0,00E+00	-5,24E-12
HTP-nc	CTUh	3,81E-08	9,40E-11	8,53E-10	1,41E-10	7,24E-09	0,00E+00	1,71E-10	6,04E-09	0,00E+00	-9,79E-11
IR	kBq U235 eqv.	7,86E-02	4,48E-04	7,35E-03	6,05E-04	1,72E-02	0,00E+00	7,36E-04	4,99E-03	0,00E+00	-7,72E-03
SQP	Pt	6,34E+00	1,15E-01	6,22E-01	1,25E-01	1,27E+00	0,00E+00	1,52E-01	4,91E-01	0,00E+00	-1,67E-01
ODP	kg CFC 11 eqv.	2,08E-05	1,55E-09	1,11E-07	2,11E-09	3,14E-06	0,00E+00	2,57E-09	4,61E-08	0,00E+00	-7,43E-09
POCP	kg NMVOC eqv.	3,93E-03	3,82E-05	1,78E-04	6,16E-05	7,68E-04	0,00E+00	7,49E-05	5,72E-04	0,00E+00	-4,78E-05
ADP-f	MJ	1,49E+01	1,03E-01	1,15E+00	1,44E-01	2,99E+00	0,00E+00	1,76E-01	1,24E+00	0,00E+00	-1,11E+00
ADP-mm	kg Sb-eqv.	7,07E-06	1,19E-07	6,57E-07	2,42E-07	1,74E-06	0,00E+00	2,95E-07	2,01E-06	0,00E+00	-3,97E-08
WDP	m ³ world eqv.	1,83E-01	3,38E-04	1,84E-02	5,16E-04	4,91E-02	0,00E+00	6,29E-04	7,75E-02	0,00E+00	-6,07E-03

AP = Acidification potential, Accumulated Exceedance (Acidification); GWP-total = Global warming potential total (Climate change total); GWP-b = Global warming potential biogenic (Climate change biogenic); GWP-f = Global warming potential fossil (Climate change fossil); GWP-luluc = Global warming potential land use and land use change

(Climate change land use and land use change); ETP-fw = Potential Comparative Toxic Unit for ecosystems (Ecotoxicity freshwater); PM = Potential incidence of disease due to PM emissions (Particulate Matter emissions); EP-m = Eutrophication potential, fraction of nutrients reaching marine end compartment (Eutrophication aquatic marine); EP-fw = Eutrophication potential, fraction of nutrients reaching freshwater end compartment (Eutrophication aquatic freshwater); EP-T = Eutrophication potential, Accumulated Exceedance (Eutrophication terrestrial); HTP-c = Potential Comparative Toxic Unit for humans (Human toxicity, cancer effects); HTP-nc = Potential Comparative Toxic Unit for humans (Human toxicity, non-cancer effects); IR = Potential Human exposure efficiency relative to U235 (Ionising radiation, human health); SQP = Potential soil quality index (Land use related impacts/Soil quality); ODP = Depletion potential of the stratospheric ozone layer (Ozone depletion); POCP = Formation potential of tropospheric ozone (Photochemical ozone formation); ADP-f = Abiotic depletion for fossil resources potential (Depletion of abiotic resources, fossils); ADP-mm = Abiotic depletion potential for non-fossil resources (Depletion of abiotic resources, minerals and metals); WDP = Water deprivation potential, deprivation-weighted water consumption (Water use)

Table 2: Results of the LCA – Resource consumption, output streams & waste categories: Omniguard 110NP (1 m²)

Parameter	Unit	A1	A2	A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	3,31E+00	1,29E-03	2,02E-01	1,81E-03	5,61E-01	0,00E+00	2,20E-03	1,49E-02	0,00E+00	-5,85E-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	3,31E+00	1,29E-03	2,03E-01	1,81E-03	5,83E-01	0,00E+00	2,20E-03	1,21E-01	0,00E+00	-5,85E-02
PENRE	MJ	1,59E+01	1,09E-01	2,55E-02	1,53E-01	2,76E+00	0,00E+00	1,87E-01	2,06E-01	0,00E+00	-1,18E+00
PENRM	MJ	0,00E+00	0,00E+00	1,19E+00	0,00E+00	1,79E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	1,59E+01	1,09E-01	1,22E+00	1,53E-01	3,17E+00	0,00E+00	1,87E-01	1,32E+00	0,00E+00	-1,18E+00
SM	kg	0,00E+00	0,00E+00	3,17E-02	0,00E+00	4,75E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	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	m ³	5,99E-03	1,18E-05	7,84E-04	1,76E-05	1,58E-03	0,00E+00	2,14E-05	2,28E-03	0,00E+00	-1,93E-04
HWD	kg	1,02E-05	2,51E-07	2,09E-06	3,66E-07	2,67E-06	0,00E+00	4,45E-07	2,34E-06	0,00E+00	-8,09E-07
NHWD	kg	4,37E-01	8,70E-03	1,53E-02	9,16E-03	7,88E-02	0,00E+00	1,11E-02	3,25E-02	0,00E+00	-1,20E-03
RWD	kg	6,91E-05	7,00E-07	6,71E-06	9,48E-07	1,52E-05	0,00E+00	1,15E-06	4,48E-06	0,00E+00	-6,69E-06
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	0,00E+00	0,00E+00	2,57E-04	0,00E+00	1,29E-02	0,00E+00	0,00E+00	6,17E-02	0,00E+00	0,00E+00
MER	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
EE-total	MJ	2,52E-01	0,00E+00	1,26E-03	0,00E+00	3,79E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-6,35E-01
EET	MJ	1,59E-01	0,00E+00	7,96E-04	0,00E+00	2,40E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-4,02E-01
EEE	MJ	9,24E-02	0,00E+00	4,62E-04	0,00E+00	1,39E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,33E-01

PERE = Renewable primary energy ex. raw materials; PERM = Renewable primary energy used as raw materials; PERT = Renewable primary energy total; PENRE = Non-renewable primary energy ex. raw materials; PENRM = Non-renewable primary energy used as raw materials; PENRT = Non-renewable primary energy total; SM = Use of secondary material; RSF = use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water; HWD = Hazardous waste disposed; NHWD =

Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE-total = Exported energy, total; EET = Exported energy thermic; EEE = Exported energy electric

6. LCA: Interpretation

For an easier understanding, the results are processed graphically, in order to recognize relationships and connections between the data more clearly.

The following figure shows the percentage of the product phases in the environmental impact categories.

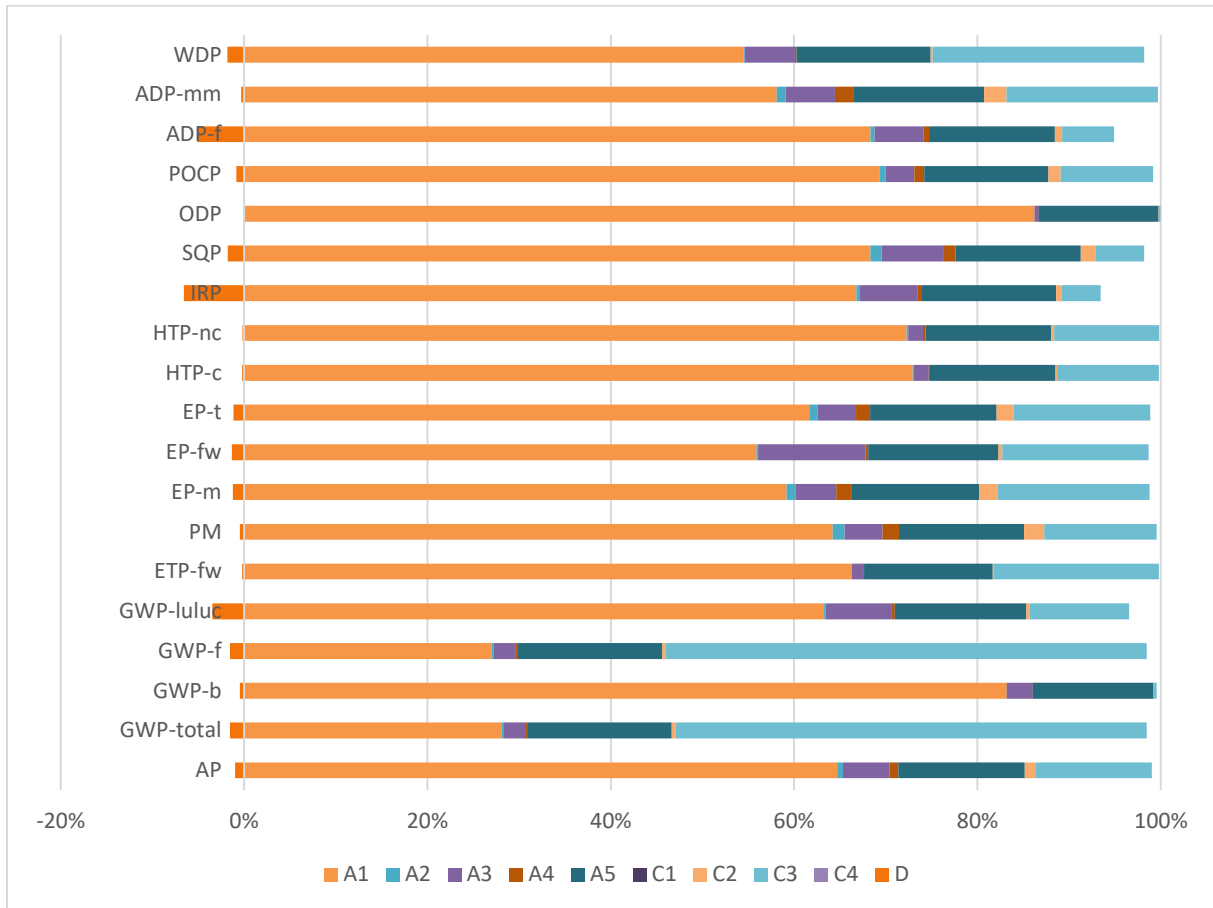


Figure 3: Percentage of the product phases in the environmental impact categories of Omniguard 110NP

The figure shows that for most of the environmental impact categories the raw material supply A1 during the production phase has the highest percentages, followed by the waste treatment C3. It can also be seen that the benefits in D predominate, represented by the negative percentage values of D.

7. References

CML, 2012	Centrum voor Milieuwetenschappen Leiden (CML); CML-IA (Baseline) version 4.1 (2012); Characterization factors by the Institute of Environmental Sciences of the Faculty of Science at the Leiden University in the Netherlands; https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors
DIN EN ISO 14040	DIN EN ISO 14040: 2009-11: Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006)
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