ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2007

SmartEPD-2024-017-0099-01

Carboguard 893 SG

carboline

SMART EPD
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION

Date of Issue: Mar 28, 2024

Expiration: Mar 28, 2029

Last updated: Mar 28, 2024

General Information

Carboline

2150 Schuetz Rd, St. Louis, MO 63146 USA

1-314-644-1000

sgelhot@carboline.com carboline.com

Product Name:	Carboguard 893 SG
Functional Unit:	1 m2 of covered and protected substrate for 60 years
Declaration Number:	SmartEPD-2024-017-0099-01
Date of Issue:	March 28, 2024
Expiration:	March 28, 2029
Last updated:	March 28, 2024
EPD Scope:	Cradle to grave A1 - A3, A4, A5, B1 - B7, C1 - C4
Market(s) of Applicability:	North America

Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2007
Core PCR:	NSF International PCR for Architectural Coatings v.1 Date of issue: June 18, 2015 Valid until: June 30, 2024
Sub-category PCR review panel:	Contact Smart EPD for more information.
General Program Instructions:	Smart EPD General Program Instructions v.1.0, November 2022

Verification Information

LCA Author/Creator:	Amy Torri | amy@parqhq.com
EPD Program Operator:	Smart EPD | info@smartepd.com | www.smartepd.com 585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA
Verification:	Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071 : External Anna Lasso | Smart EPD | anna.lasso@smartepd.com Independent external verification of EPD, according to ISO 14025 and reference PCR(s) : External Anna Lasso | Smart EPD | anna.lasso@smartepd.com

Limitations, Liability, and Ownership

In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

The EPD owner shall have sole ownership, liability, and responsibility for the EPD.

Organization Information

For over seven decades, Carboline has been at the forefront of delivering cutting-edge product development alongside a wealth of technical expertise and experience, offering unparalleled protective coating solutions on a global scale. As a notable manufacturer of paint and coating products, Carboline is dedicated to showcasing its sustainability leadership while recognizing the business value in transparently reporting the comprehensive environmental impacts of its products, spanning from cradle to grave. For further details on Carboline's product range, visit their website at https://www.carboline.com/.

Further information can be found at: https://www.carboline.com

Product Description

Carboguard 893 SG is a versatile corrosion resistant coating. It can be used either as a primer, intermediate coat, or self-priming finish over steel and zinc primers. Carboline glass flake additive may be added to improve performance including internal strength, hardness, impact, and abrasion resistance. It may be topcoated with itself, or a broad variety of high performance finish coats. It also has surface tolerant properties.

Further information can be found at: https://www.carboline.com/products/product-details/Carboguard-893-SG

Product Information

Functional Unit:	1 m2 of covered and protected substrate for 60 years
Mass:	1.624 kg
Reference Service Life:	10 Years

Product Specificity:

- ✗ Product Average
- ✓ Product Specific

Averaging:

Averaging was not conducted for this EPD.

Plants

Carboline - Lake Charles, LA
2425 Fruge Street, Lake Charles, LA, USA

Product Specifications

Product SKU(s):	1000WITE97SD, 1000WITEARND,10000908B05D
Product Classification Codes:	Masterformat - 09 96 00 EC3 - Finishes -> PaintingAndCoating
Architectural Coating Subcategory:	Exterior Architectural Coating
Quality Designation:	High Quality
Design Life:	20 years
Market-Based Lifetime:	10 years
Industry Durability Test:	ISO 12944-6
Amount of Colorant Needed per Liter of Coating:	23 ml

Material Composition

Material/Component Category	Origin	% Mass
Resin	US	10-20
Solvent	US	10-15
Additive	US	10-20
Hardener	US	5-15
Fillers	US	30-55
Colorant	US	0-5

Packaging Material	Origin	kg Mass
Steel Pail	US	1.51E-01

Hazardous Materials
Benzyl alcohol (CAS 100-51-6)
BISPHENOL A EPOXY RESIN (CAS 25068-38-6)
ALKYL GLYCIDYL ETHER (CAS 68609-97-2)
POLYAMIDE (CAS 68410-23-1)
Isophoronediamine (CAS 2855-13-2)
META-XYLENE (CAS 108-38-3)
2-PIPERAZIN-1- YLETHYLAMINE (CAS 140-31-8)
TRIS-2,4,6-(DIMETHYLAMINOMETHYL)PHENOL (CAS 90-72-2)
PARA-XYLENE (CAS 106-42-3)
ETHYL BENZENE (CAS 100-41-4)
ORTHO-XYLENE (CAS 95-47-6)
Epoxy phenol novolac resin (CAS 28064-14-4)
4-tert-Butylphenol (CAS 98-54-4)

EPD Data Specificity

Primary Data Year: 2022-2023

Manufacturing Specificity:

- ✗ Industry Average
- ✗ Manufacturer Average
- ✗ Facility Specific

Software and LCI Data Sources

LCA Software: SimaPro v. 9.5

LCI Foreground Database(s): Ecoinvent v. 3.9.1 | North America | cut-off

LCI Background Database(s): Ecoinvent v. 3.9.1 | North America | cut-off

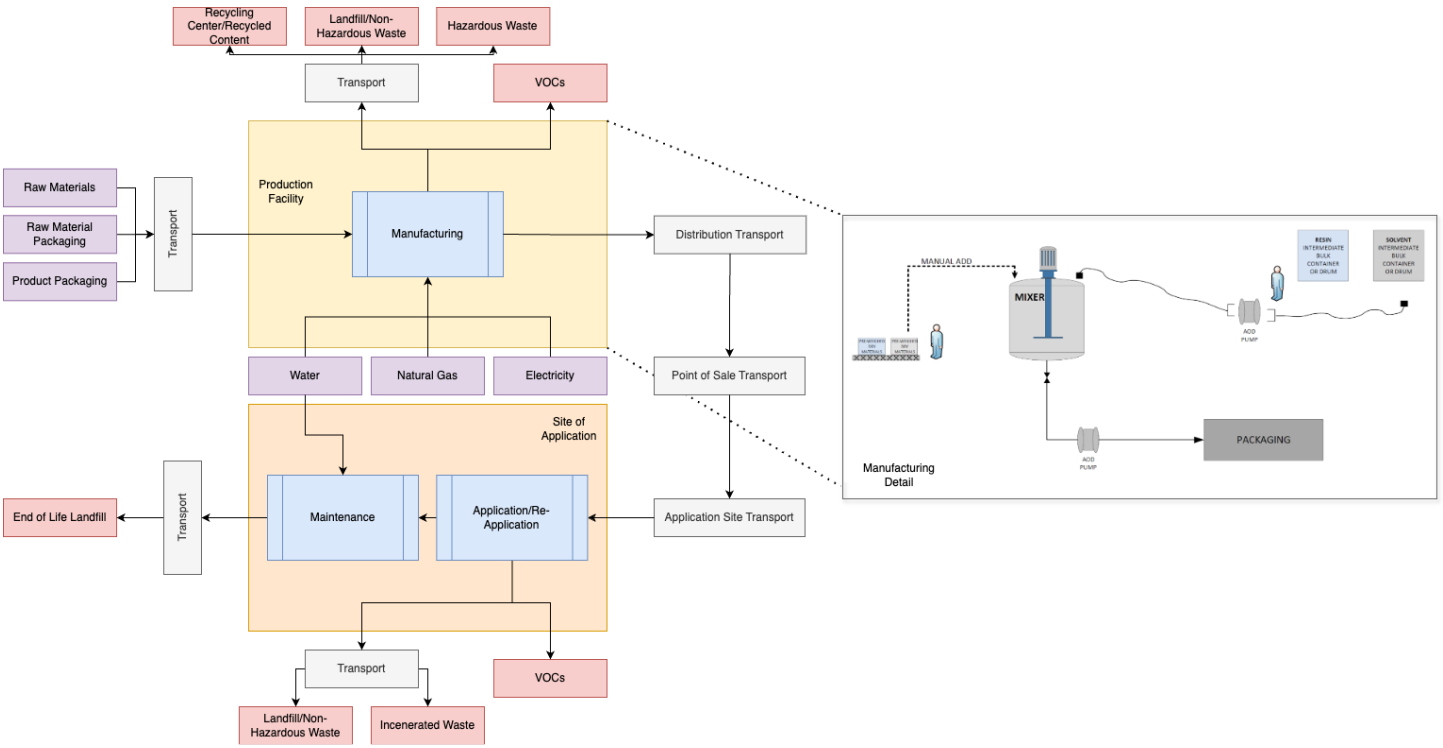
Renewable Electricity

Renewable electricity is used: No

System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	✓
	A5	Assembly / Install	✓
Use	B1	Use	✓
	B2	Maintenance	✓
	B3	Repair	✓
	B4	Replacement	✓
	B5	Refurbishment	✓
	B6	Operational Energy Use	✓
	B7	Operational Water Use	✓
End of Life	C1	Deconstruction	✓
	C2	Transport	✓
	C3	Waste Processing	✓
	C4	Disposal	✓
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Product Flow Diagram



Life Cycle Module Descriptions

The manufacturing of this product involves the direct procurement of raw materials from suppliers in module A1. In module A2, the raw material suppliers transport the materials, along with the associated packaging, to Carboline's manufacturing facility in Lake Charles, LA, where they are stored and mixed to produce the coatings in module A3. Mixing and blending of raw materials occur using manual and air-operated diaphragm pumps in the mixer. The end result is the mixed product. For the products manufactured at the Lake Charles, Louisiana facility, scrap, packaging waste and non-hazardous waste are assumed to be shipped to the Waste Management Lake Charles facility, located 6 kilometers away from Carboline's plant. Hazardous waste is assumed to be sent to the CWM Lake Charles management facility for disposal in Sulphur (37 km away). The coating is distributed and sold across North America in module A4. Use of the product consists of daily maintenance cleaning with a mop and a cleaning solution such as Hillyard SM-1® Industrial Cleaner Degreaser in module B2. Necessary recoats (re-applications) of the product to achieve service life are modeled in module B4 per the PCR. The plastic or steel can packaging is discarded to landfill and a 2% coating loss rate during application is assumed per the PCR (for both initial application and any recoats). End of life impacts include transport to disposal and final waste processing in modules C2 and C3, respectively, and landfilling of the substrate with applied coating in module C4, per the PCR.

LCA Discussion

Allocation Procedure

Product packaging was allocated by mass. Manufacturing inputs requiring allocation were electricity and natural gas as the production of multiple products is measured using a single meter for each. The allocation of each was based on the percentage of production for the product in question divided by the total site production output.

Cut-off Procedure

The model includes over 95% of the total material mass, energy and environmental relevance throughout the product lifetime. Cut-off rules do not apply for hazardous or toxic materials, and the materials were included in the study.

Data Quality Discussion

The quality of inventory data is evaluated based on several criteria, including precision, completeness, consistency, and representativeness.

Precision and Completeness

- Precision: The inventory data used in this study were either directly measured, calculated, or estimated based on primary data sources, ensuring high precision. Background data from ecoinvent v3.9.1 database also has documented precision to the extent available.
- Completeness: The product system's mass balance and inventory completeness were thoroughly checked. Some exclusions were made in line with the PCR requirements, such as personnel impacts, R&D activities, business travel, secondary packaging, point of sale infrastructure, and the coating applicator. However, no data was intentionally omitted..

Consistency and Reproducibility

- Consistency: Primary data were collected with a similar level of detail, while background data came from the ecoinvent v3.9.1 database. The modeling approach and other methodological choices were applied consistently throughout the model. Default values from the PCR were considered where there was unavailability of primary data, For example, the default waste transport distance was used for product disposal assessment.
- Reproducibility: This study ensures reproducibility by providing comprehensive disclosure of input-output data, dataset choices, and modeling approaches. A knowledgeable third party should be able to approximate the results using the same data and modeling methods.

Representativeness

- Temporal: Primary data were collected for the one-year period of October 2022 to September 2023 to ensure the representativeness of post-consumer content. Secondary data from the ecoinvent v3.9.1 database is typically representative of recent years.
- Geographical: Primary data represent Carboline's production facilities in Green Bay (Wisconsin), Dayton (Nevada) and Lake Charles (Louisiana). Where applicable, differences in electric grid mix were considered using appropriate secondary data. The use of country-specific data ensures high geographical representativeness, and proxy data were only used when country-specific data were unavailable.
- Technological: Both primary and secondary data were tailored to the specific technologies studied, ensuring high technological representativeness. Where no direct raw material information was available in the ecoinvent 3.9 database, proxies were identified and used.

Results

Environmental Impact Assessment Results

TRACI 2.1, IPCC AR5 GWP 100

per 1 m2 of covered and protected substrate for 60 years.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Industrial - Market Service Life

Impact Category	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
ODP	kg CFC 11 eq	2.48e-7	3.82e-9	2.22e-9	2.54e-7	2.67e-9	0	1.30e-11	0	0	1.29e-6	0	0	0	0	1.71e-10	4.02e-9	6.74e-10
AP	kg SO2 eq	5.20e-3	1.50e-3	3.15e-4	7.01e-3	8.66e-4	0	5.18e-6	0	0	3.94e-2	0	0	0	0	5.55e-5	3.85e-4	2.79e-4
EP	kg N eq	1.02e-3	1.14e-4	6.61e-5	1.20e-3	7.29e-5	0	3.45e-5	0	0	6.55e-3	0	0	0	0	4.67e-6	3.63e-5	2.22e-3
POCP	kg O3 eq	5.58e-2	3.99e-2	4.31e-3	1.00e-1	2.42e-2	0	9.16e-5	0	0	6.22e-1	0	0	0	0	1.55e-3	5.07e-3	4.39e-3
GWP-fossil	kg CO2 eq	9.90e-1	2.33e-1	8.76e-2	1.31e+0	1.62e-1	0	1.54e-3	0	0	7.37e+0	0	0	0	0	1.04e-2	5.88e-1	8.93e-2
GWP-total	kg CO2 eq	1.05e+0	2.34e-1	9.28e-2	1.38e+0	1.63e-1	0	2.09e-2	0	0	7.81e+0	0	0	0	0	1.04e-2	5.89e-1	1.34e+0

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Technical Service Life

Impact Category	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
ODP	kg CFC 11 eq	2.48e-7	3.82e-9	2.22e-9	2.54e-7	2.67e-9	0	1.30e-11	0	0	5.14e-7	0	0	0	0	8.55e-11	2.01e-9	3.37e-10
AP	kg SO2 eq	5.20e-3	1.50e-3	3.15e-4	7.01e-3	8.66e-4	0	5.18e-6	0	0	1.58e-2	0	0	0	0	2.78e-5	1.93e-4	1.40e-4
EP	kg N eq	1.02e-3	1.14e-4	6.61e-5	1.20e-3	7.29e-5	0	3.45e-5	0	0	2.62e-3	0	0	0	0	2.34e-6	1.81e-5	1.11e-3
POCP	kg O3 eq	5.58e-2	3.99e-2	4.31e-3	1.00e-1	2.42e-2	0	9.16e-5	0	0	2.49e-1	0	0	0	0	7.77e-4	2.54e-3	2.20e-3
GWP-fossil	kg CO2 eq	9.90e-1	2.33e-1	8.76e-2	1.31e+0	1.62e-1	0	1.54e-3	0	0	2.95e+0	0	0	0	0	5.18e-3	2.94e-1	4.46e-2
GWP-total	kg CO2 eq	1.05e+0	2.34e-1	9.28e-2	1.38e+0	1.63e-1	0	2.09e-2	0	0	3.12e+0	0	0	0	0	5.21e-3	2.94e-1	6.69e-1

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicators

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Market Service Life

Indicator	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	MJ, net calorific value	5.72e-1	3.10e-2	7.56e-2	6.79e-1	2.08e-2	0	3.58e-4	0	0	3.50e+0	0	0	0	0	1.33e-3	1.23e-2	2.18e-2
PERM	MJ, net calorific value	4.73e-1	1.27e-2	1.68e-2	5.02e-1	8.13e-3	0	7.81e-5	0	0	2.55e+0	0	0	0	0	5.21e-4	3.14e-3	4.52e-3
PERT	MJ, net calorific value	1.04e+0	4.37e-2	9.24e-2	1.18e+0	2.90e-2	0	4.36e-4	0	0	6.05e+0	0	0	0	0	1.85e-3	1.55e-2	2.63e-2
PENRE	MJ, net calorific value	1.74e+1	3.24e+0	1.41e+0	2.21e+1	2.29e+0	0	1.09e-2	0	0	1.22e+2	0	0	0	0	1.47e-1	2.64e+0	5.57e-1
PENRM	MJ, net calorific value	9.85e-4	5.07e-5	4.80e-5	1.08e-3	3.33e-5	0	7.16e-7	0	0	5.59e-3	0	0	0	0	2.11e-6	1.02e-5	4.40e-5
PENRT	MJ, net calorific value	1.74e+1	3.24e+0	1.41e+0	2.21e+1	2.29e+0	0	1.09e-2	0	0	1.22e+2	0	0	0	0	1.47e-1	2.64e+0	5.57e-1
ADPF	MJ, net calorific value	2.03e+0	4.53e-1	1.42e-1	2.62e+0	3.21e-1	0	1.33e-3	0	0	1.47e+1	0	0	0	0	2.05e-2	3.93e-1	6.56e-2
SM	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RSF	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RE	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	m3	2.22e-2	3.71e-4	4.00e-4	2.30e-2	2.58e-4	0	7.93e-6	0	0	1.16e-1	0	0	0	0	1.65e-5	2.61e-4	4.94e-4

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Technical Service Life

Indicator	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	MJ, net calorific value	5.72e-1	3.10e-2	7.56e-2	6.79e-1	2.08e-2	0	3.58e-4	0	0	1.40e+0	0	0	0	0	6.67e-4	6.17e-3	1.09e-2
PERM	MJ, net calorific value	4.73e-1	1.27e-2	1.68e-2	5.02e-1	8.13e-3	0	7.81e-5	0	0	1.02e+0	0	0	0	0	2.60e-4	1.57e-3	2.26e-3
PERT	MJ, net calorific value	1.04e+0	4.37e-2	9.24e-2	1.18e+0	2.90e-2	0	4.36e-4	0	0	2.42e+0	0	0	0	0	9.27e-4	7.74e-3	1.31e-2
PENRE	MJ, net calorific value	1.74e+1	3.24e+0	1.41e+0	2.21e+1	2.29e+0	0	1.09e-2	0	0	4.87e+1	0	0	0	0	7.33e-2	1.32e+0	2.79e-1
PENRM	MJ, net calorific value	9.85e-4	5.07e-5	4.80e-5	1.08e-3	3.33e-5	0	7.16e-7	0	0	2.24e-3	0	0	0	0	1.05e-6	5.12e-6	2.20e-5
PENRT	MJ, net calorific value	1.74e+1	3.24e+0	1.41e+0	2.21e+1	2.29e+0	0	1.09e-2	0	0	4.88e+1	0	0	0	0	7.33e-2	1.32e+0	2.79e-1
ADPF	MJ, net calorific value	2.03e+0	4.53e-1	1.42e-1	2.62e+0	3.21e-1	0	1.33e-3	0	0	5.89e+0	0	0	0	0	1.03e-2	1.96e-1	3.28e-2
SM	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RSF	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RE	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	m3	2.22e-2	3.71e-4	4.00e-4	2.30e-2	2.58e-4	0	7.93e-6	0	0	4.65e-2	0	0	0	0	8.26e-6	1.30e-4	2.47e-4

Abbreviations:

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Waste and Output Flow Indicators

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Market Service Life

Indicator	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	kg	4.46e-4	7.76e-5	3.12e-3	3.64e-3	5.70e-5	0	1.93e-5	0	0	1.86e-2	0	0	0	0	3.65e-6	5.86e-5	1.24e-3
NHWD	kg	2.00e-1	1.43e-1	2.95e-2	3.72e-1	1.10e-1	0	2.54e-2	0	0	2.54e+0	0	0	0	0	7.05e-3	1.43e-2	1.63e+0
RWD	kg	1.06e-5	6.84e-7	8.59e-7	1.21e-5	4.61e-7	0	8.24e-9	0	0	6.33e-5	0	0	0	0	2.95e-8	2.58e-7	5.01e-7
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	1.60e-3	1.60e-3	0	0	0	0	0	8.02e-3	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Technical Service Life

Indicator	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	kg	4.46e-4	7.76e-5	3.12e-3	3.64e-3	5.70e-5	0	1.93e-5	0	0	7.44e-3	0	0	0	0	1.83e-6	2.93e-5	6.18e-4
NHWD	kg	2.00e-1	1.43e-1	2.95e-2	3.72e-1	1.10e-1	0	2.54e-2	0	0	1.02e+0	0	0	0	0	3.52e-3	7.15e-3	8.14e-1
RWD	kg	1.06e-5	6.84e-7	8.59e-7	1.21e-5	4.61e-7	0	8.24e-9	0	0	2.53e-5	0	0	0	0	1.47e-8	1.29e-7	2.51e-7
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	1.60e-3	1.60e-3	0	0	0	0	0	3.21e-3	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Carbon Emissions and Removals

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Market Service Life

Indicator	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
BCRP	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BCEP	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BCRK	kg CO2	-4.75e-4	0	0	-4.75e-4	0	0	0	0	0	-2.38e-3	0	0	0	0	0	0	0
BCEK	kg CO2	0	0	4.75e-4	4.75e-4	0	0	0	0	0	2.38e-3	0	0	0	0	0	0	0
BCEW	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCE	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCR	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWNR	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

per 1 m2 of covered and protected substrate for 60 years.

Industrial - Technical Service Life

Indicator	Unit	A1	A2	A3	A1A2A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
BCRP	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BCEP	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BCRK	kg CO2	-4.75e-4	0	0	-4.75e-4	0	0	0	0	0	-5.23e-3	0	0	0	0	0	0	0
BCEK	kg CO2	0	0	4.75e-4	4.75e-4	0	0	0	0	0	5.23e-3	0	0	0	0	0	0	0
BCEW	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCE	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCR	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWNR	kg CO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

Scenarios

Transport to the building/construction site (A4)

A4 Module

Fuel Type:	Diesel
Vehicle Type:	Truck and Trailer
Transport Distance:	2285 km
Capacity Utilization:	33 %
Packaging Mass:	0.151 kg
Gross density of products transported:	1492 kg/m3
Weight of products transported:	1.624 kg
Volume of products transported:	0.001 m3
Capacity utilization volume factor:	1
Assumptions for scenario development:	Transport distance includes finished product to distribution center and distribution center to point of sale.- Passenger van assumed for point of sale to application site, with a distance of 8km using same packging and capacity assumptions.

Installation in to the building/construction site (A5)

A5 Module

Product Lost per Functional Unit:	0.162 kg
Mass of Packaging Waste Specified by Type:	0.151 kg
VOC Emissions:	324000000000 ug/m3
VOC Test Method:	ASTM D-2369

Reference Service Life

B1 Module

RSL: 10 Cycles

Declared Product Properties:

Designed to provide corrosion resistant coating. It is VOC compliant to current AIM regulations. This product is is available as a two kit system.

Design Application Parameters:

Spraying or brush-rolling as the preferred method of application. Substrate temperature for metal must be between 50°F and 110°F. Relative humidity must not exceed 95%. Substrate temperature must be above the Dew Point. This product requires separate onsite power mixing of two kits and then their combination. Cure cycle is temperature-dependent. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times. Consult product technical data sheet for detailed application parameters. Consult a Carboline representative.

An Assumed Quality of Work, When Installed in Accordance with The Manufacturer's Instructions:

Long term protection is achieved when installed in accordance with manufacturer's instructions. Theoretical coverage is 1011 ft2/gal at 3-6 mils.

Maintenance:

Replacement (B4)

B4 Module

Reference Service Life:	10 Years
Replacement Cycle:	5 (ESL/RSL)-1
Further assumptions for scenario development:	Product is assumed to be applied in an industrial environment. A 10 year market service lifetime and a 20 year technical service lifetime was adopted in the LCA model. For the market service-based lifetime, one initial coating application and 5 recoats are required to maintain the average lifespan of a building, assumed to be 60 years. For the technical service-based lifetime, one initial coating application and 2 recoats are required to maintain the 60 year building lifespan.

End of Life

C1 - C4 Modules

Collection Process

Collected Separately:	0.162 kg
Collected with Mixed Construction Waste:	1.461 kg

Recovery

Landfill:	1.461 kg
Incineration:	0.162 kg

Disposal

Product or Material for Final Disposal:	1.624 kg

Assumptions for scenario development:

The US EPA WARM model was used to determine the processes used to dispose of waste materials (coatings at the end of life in demolition waste) and unused product.

Interpretation

Data was collected for 12 month periods spanning calendar years 2022 and 2023 to ensure the representativeness of business activities and post-consumer materials. Manufacturing data represents Carboline's production facility in Green Bay, Wisconsin. Secondary data was obtained from ecoinvent v3.9.1, representing the most recent years available. The overall quality of the data used is considered representative of the product systems.

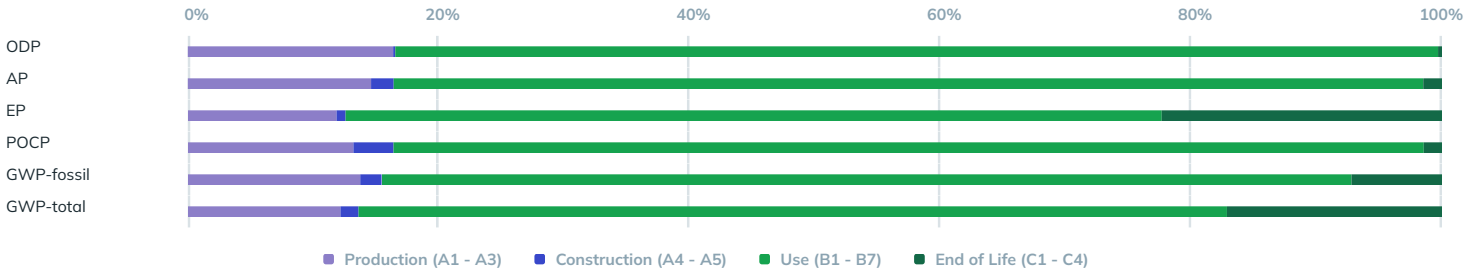
The system boundary is cradle to grave, excluding: construction of major capital equipment; research and development activities; point of sale infrastructure; coating applicator and its maintenance and operation; human labor and employee transport; raw material, forming, and disposal impacts from secondary/tertiary packaging; disposal of packaging materials not associated with final product; impacts associated with tool (mop) required for maintenance cleaning; building operational energy and water use; deconstruction and demolition.

Overall, the production and construction stages (modules A1-A4, 30% of total impact) combined with the replacement module of the use stage (B4, 50-65% of total impact), have the highest impact across all impact categories , followed by the end-of-life stage (C1-C4). Note that the B4 module includes the A1-A4 modules for each recoat required for the product's lifetime. The upstream raw material phase (A1) is the primary contributor to all impact categories. This is largely due to the number of different raw material processes required to produce the product.

The construction phase (A4), includes the transportation of the product from manufacturing to the customer. The transportation miles from the point of sale to the application site (A4) account for low impacts across all impact categories.

The use phase includes maintenance cleaning and recoats of the product. The maintenance of the product provides marginal contribution to the overall impact categories. As mentioned above, the replacement module (B4) is the primary impact driver for all the products.

Waste disposal (C4) emerges as a major contributor to eutrophication and global warming. Waste processing (C3) significantly impacts carcinogenicity, ecotoxicity, and global warming. Waste transport (C2) exhibits relatively low overall impact.



Additional Environmental Information

Before using this product, it is recommended that the operator read and follow all caution statements on the product data sheet and on the SDS for this product, and personal protective equipment must be used as directed.

References

[1] ISO 14040:2006/Amd 1:2020, “Environmental management - Life cycle assessment - Principles and framework”.
[2] ISO 14044:2006/Amd 1:2017/Amd 2:2020, “Environmental management - Life cycle assessment - Requirements and guidelines”.
[3] ISO 21930:2017, “Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services”.
[4] NSF International, Product Category Rules for Environmental Product Declarations for Architectural Coatings, June 2015.
[5] ISO 14025:2006, “Environmental labels and declarations - Type III environmental declarations - Principles and procedures”.
[6] Bare, J. 2014. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) TRACI version 2.1 User’s Guide. US EPA Office of Research and Development, Washington, DC, EPA/600/R-12/554, http://nepis.epa.gov/Adobe/PDF/P100HN53.pdf
[7] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp. https://www.ipcc.ch/report/ar5/wg1/
[8] ecoinvent v3.9.1, December 2022, https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-9-1/
[9] US Environmental Protection Agency Waste Reduction Model (WARM) v15, September 2022, https://www.epa.gov/warm/versions-waste-reduction-model-warm#15
[10] Ryberg, M., M. Vieira, M. Zgola, et al. Updated US and Canadian Normalization Factors for TRACI 2.1. CLEAN TECHNOLOGIES ENVIRONMENTAL POLICY. Springer, New York, NY, 16(2):329-339 (2014). http://dx.doi.org/10.1007/s10098-013-0629-z
[11] Weidema B. P., C. Bauer, R. Hischier, et al. Overview and methodology. Data quality guideline for the ecoinvent database version 3. Ecoinvent Report 1(v3), St. Gallen: The ecoinvent Centre (2013). https://ecoinvent.org/wp-content/uploads/2021/09/dataqualityguideline_ecoinvent_3_20130506.pdf
[12] Facts and figures about materials, waste and recycling (2018). https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling
[13] Carboline Internal Report, Life Cycle Assessment of Carboquick 200 Coating, September 2023
[14] Carboline Internal Report, Amendment to Life Cycle Assessment of Carboquick 200 Coating for Sixteen Additional Coatings, March 2024