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Environmental Product Declaration – H&C™ Shield-Crete® Water-Based Epoxy[1]

Certified Environmental Product Declaration
www.nsf.org

Shield-Crete® Water-Based Epoxy Garage Floor Coating system delivers durable, high-gloss color that stands up to life in the garage. This two-part epoxy penetrates deeply into concrete, creating a hard, durable surface that resists peeling and hot tire pickup for long-lasting beauty.

The product image to the right is an example of one of the formulas covered by the EPD. A list of all relevant H&C™ Shield-Crete® Water-Based Epoxy formulas is shown in Table 1 on page 2 of the EPD.

Declaration Holder	The Sherwin-Williams Company (sustainability@sherwin.com)
Declaration Number	EPD10923
Declared Product	H&C™ Shield-Crete® Water-Based Epoxy
Product Category and Subcategory	Resinous Floor Coatings – Thin-mil
Program Operator	NSF Certification LLC ncss@nsf.org
Reference PCR	PCR for Resinous Floor Coatings – 12/2018
Link to available EPDs	https://www.nsf.org/certified-products-systems

Date of Issue	January 25, 2024
Period of Validity	5 Years

Contents of the Declaration	– Product definition and material characteristics – Overview of manufacturing process – Information about in-use conditions – Life cycle assessment results

The PCR review was conducted by	Thomas P. Gloria, Ph. D. t.gloria@industrial-ecology.com

This EPD was independently verified by NSF International in accordance with ISO 21930:2017 and ISO 14025. **☐ Internal ☒ External**	Jack Geibig – EcoForm jgeibig@ecoform.com	Jack Geibig
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by	Jack Geibig – EcoForm jgeibig@ecoform.com	Jack Geibig

Functional Unit:	1m^2 of covered and protected substrate for a period of 60 years (the assumed average lifetime of a building)
Scope	Cradle to Grave
Market-Based Lifetime Used in Assessment	10 years (Commercial Application) 5 years (Industrial Application)
Technical Lifetime Used in Assessment	15 years (Commercial Application) 5 years (Industrial Application)
Estimated Amount of Colorant	Varies (see Table 2)
Data Quality Assessment Score	Very Good
Manufacturing Location(s)	Various Plants Throughout the United States
LCA Software Program Used	LCA for Experts/GaBi (10.0.0.71)

[1] 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.

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ISO21930:2017 – serves as the core PCR PCR for Resinous Floor Coatings PCR review was conducted by: Thomas P. Gloria, Ph. D., Mr. Bill Stough, Mr. Jack Geibig PCR for Resinous Floor Coatings review was conducted by: Thomas P. Gloria, Ph. D., Mr. Bill Stough, Mr. Jack Geibig NSF International – National Center for Sustainability Standards, ncss@nsf.org
Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006 ☐ internal **X** external
Jack Geibig - EcoForm

Product Definition:

H&C™ Shield-Crete® Water-Based Epoxy is a resinous floor coating manufactured by The Sherwin-Williams Company, headquartered in Cleveland, Ohio. H&C™ Shield-Crete® Water-Based Epoxy is manufactured in a number of Sherwin-Williams facilities across the United States and the data used by the LCA were representative of all Sherwin-Williams facilities in which H&C™ Shield-Crete® Water-Based Epoxy was produced. These Sherwin-Williams resinous floor coatings are field applied and designed to cover and protect floors from foot traffic in commercial and industrial spaces. For information about specific products, please visit www.hcconcrete.com.

Product Classification and Description:

The H&C™ Shield-Crete® Water-Based Epoxy products listed below are included within this assessment. The product system consists of a Part A base and a Part B hardener. There are also optional deco-flakes. For information on other attributes of each of the specific formulations, please visit www.hcconcrete.com.

Table 1. List of H&C™ Shield-Crete® Water-Based Epoxy Formulas Assessed by LCA Model and Report.

Kit SKU Number (Part A + Part B)	**Product ID for EPD**	**Product Numbers Included**	**Product Info**
20.113000-99	**20.113000**	21.104100	Part A – Extra White Tint Base
20.114000-99	**20.114000**	21.104200	Part A – Deep Tiny Base
20.115000-99	**20.115000**	21.104300	Part A – Ultra Deep Base
20.117000-99	**20.117000**	21.104500	Part A - Clear
20.117006-99*			
20.116000-99	**20.116000**	21.104400	Part A – Concrete Gray
20.116006-99*			
-	**21.104600**	21.104600	Part B - Hardener
	Mix Ratio- 1 Gallon Part A: 1 Quart Part B (**4:1**)		

*Canadian item code

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Table 2. Optional Deco-flakes

SKU Number	Product Description
20.105100-99	Blue Chip Creek Deco-Flakes
20.105200-99	Salt & Pepper Deco-Flakes
20.105300-99	Earthy Mosaic Deco-Flakes
20.105400-99	Pebble Beach Deco-Flakes
1 lb bag covers 250 sq. ft. – spread rate used for EPD	

Under the Product Category Rule (PCR) for Resinous Floor Coatings, H&C™ Shield-Crete® Water-Based Epoxy falls under the following heading:

> "a fluid-applied and poured/formed in place and cured material coating used to protect and enhance horizontal substrates such as concrete, metal, and wood from foot traffic."

Resinous Floor Coatings are manufactured in a way similar to other paint and coating products. Raw materials are manually added in appropriate quantities into a high-speed disperser which are mixed. The product is then moved via compressed air or gravity and filled into containers and transported to the distribution center and finally to the point of sale. A customer travels to the store to purchase the product and transports the coating to the site where it is applied. The applied coating adheres to the substrate where it remains until the substrate is disposed by the user. Any unused coating will be disposed by the purchaser as well. Because the functional unit mandates a 60-year product life, multiple recoats were necessary and were accounted for in the LCA models in Module B4.

The typical composition of a H&C™ Shield-Crete® Water-Based Epoxy resinous floor coating system (as mixed) is shown below. The typical composition of the optional deco-flakes is listed as well.

Flooring System (mixed)
Water 45% - 50%
Resins 20% - 30%
Extender/Pigments 1% - 10%
Additives 1% - 10%
Solvents <5%

Deco-flakes
Extender/Pigments 75%-85%
Resins 15% - 25%

Table 3. List of Hazardous ingredients in H&C™ Shield-Crete® Water-Based Epoxy Formulas.

	Ingredient	Percentage	CAS #
Part A	Epoxy Resin	≥25 - ≤50	69761-19-9
	Titanium Dioxide	≤10	13463-67-7
	Carbon Black	≤0.3	1333-86-4
Part B	Poly(oxypropylene)diamine	<3	9046-10-0
	3,6,9-triazaundecamethylenediamine	<1	112-57-2
Deco-Flakes (Optional)	Barium Sulfate	≥50 - ≤75	7727-43-7
	Titanium Dioxide	≤10	13463-67-7
	Carbon Black	≤3	1333-86-4

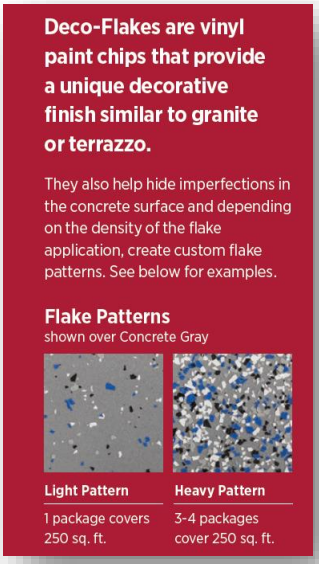
Other than the materials listed above in Table 3, there are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting under the Global Harmonized Standard. Note that some of these materials may only appear in one or two bases across the entire product line. For additional information about product hazards, please refer to the Safety Data Sheet for the specific H&C™ Shield-Crete® Water-Based Epoxy formula available on www.hcconcrete.com.

Table 4. Typical Physical Properties for H&C™ Shield-Crete® Water-Based Epoxy flooring system.

PHYSICAL PROPERTIES

Typical Physical Properties and Characteristics		
Property	**Test Method**	**Value**
Dry Time (@ 77°F, 50% RH)	Dry-to-touch	45 minutes
	Foot traffic	18 hours
	Heavy traffic	72 hours
	Recoat	6 hours min., 72 hours max.
	Full cure	7 days
Flash Point	ASTM D3828	>230°F (110°C), Mixed
VOC	EPA Method 24	<50 g/L*
Perm Rating	ASTM D1653	2 grains (hr. ft^2 in Hg)
Sheen	ASTM D523	Gloss
Solids by Volume Solids by Weight	NVV ASTM D2369-04	41% ± 2%*, mixed 50% ± 2%*, mixed
Induction Time	(@ 50°F, 50% RH)	None
	(@ 77°F, 50% RH)	None
Pot Life	(@ 50°F, 50% RH)	8 hours
	(@ 77°F, 50% RH)	5.5 hours
Shelf Life (unopened)		Part A: 24 months Part B: 36 months

**May vary depending on color*



A deco-flake coverage rate of 250 sq. ft. per 1lb. package was used for this EPD.

See PDS for additional technical information. www.hcconcrete.com.

Coverage	**200 - 250 sq ft**
Thickness	Approx. 2.5 mils (dry)
Coverage rate used for EPD	250 sq ft

About Sherwin-Williams:

For more than 155 years, Sherwin-Williams has provided contractors, builders, property managers, architects, and designers with the trusted products they need to build their business and satisfy customers. H&C™ Shield-Crete® Water-Based Epoxy is just one more way we bring you industry-leading coatings technology — innovation you can pass on to your customers. Plus, with more than 4,800 stores and 2,400 sales representatives across North America, personal service and expert advice is always available near jobsites. Find out more about H&C™ Shield-Crete® Water-Based Epoxy at your nearest Sherwin-Williams store or to have a sales representative contact you, call 800-524-5979.

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Definitions:

Acronyms & Abbreviated Terms:

ACA: American Coatings Association
ASTM: ASTM International, a standards development organization that serves as an open forum for the development of international standards. ASTM methods are industry-recognized and approved test methodologies for demonstrating the durability of a various coating types in the United States.
ecoinvent: A life cycle database that contains international industrial life cycle inventory data on energy supply, resource extraction, material supply, chemicals, metals, agriculture, waste management services, and transport services.
EPA WARM model: United States Environmental Protection Agency Waste Reduction Model.
EPD: Environmental Product Declaration. EPDs are form of as Type III environmental declarations under ISO 14025:2006. They are the summary document of data collected in the LCA as specified by a relevant PCR. EPDs can enable comparison between products if the underlying studies and assumptions are similar.
GaBi: Created by thinkstep, GaBi Databases are LCA databases that contain ready-to-use Life Cycle Inventory profiles.
LCA: Life Cycle Assessment. A technique to assess environmental impacts associated with all the stages of a product's life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling), as defined in ISO 14040:2006.
NCSS: NSF International's National Center for Sustainability Standards
PCR: Product Category Rule. A PCR defines the rules and requirements for creating EPDs of a certain product category, as described in ISO 14025:2006.

Terminology:

Adhesion: the degree of attachment between two surfaces held together by interfacial forces.
Basecoats: coatings applied to the surface after preparation and before the application of a finish coat.
Commercial Project: Projects not used for residential, manufacturing, processing, or assembly purposes. Common commercial project types include education, healthcare, hospitality, entertainment, retain, and construction.
Generic data: Defined by the ILCD handbook as "a generic data set has been developed using at least partly other information then those measured for the specific process. This other information can be stoichiometric or other calculation models, patents and other plans for processes or products, expert judgment etc. Generic processes can aim at representing a specific process or system or an average situation. Both specifically measured data and generic data can hence be used for the same purpose of representing specific or average processes or systems."
Failure: The physical degradation of the floor surfacing material which would require substantial or complete removal in order to return the floor to serviceable condition.
Industrial Project: Any project where the primary activity includes the manufacture, production, processing, assembly, or handling of goods or materials. This could include use conditions such as heavy wheeled traffic or the use of fixed of moving machinery. For example, in a maintenance facility or as an automotive shop.
Intermediate processing: the conversion of raw materials to intermediates (e.g. titanium dioxide ore into titanium dioxide pigment, etc.).

Market Service Lifetime: The estimated lifetime of a resinous floor coating based off the predicted use pattern of the product type.
Pigment: The material(s) that give a coating its color.
Primers: materials applied to a surface to promote adhesion between the substrate and subsequent coats.
Primary materials: Resources made from materials initially extracted from nature. Examples include titanium dioxide ore, petroleum, etc. that are used to create basic materials used in the production of coatings (e.g., pigment, solvents)
Resin / Binder: Acts as the glue or adhesive to adhere the coating to the substrate.
Secondary materials: Materials that contain recovered, reclaimed, or recycled content that is used to create basic materials for the production of coatings (e.g. aluminum scrap).
Technical Service Lifetime: The estimated lifetime of a coating based solely on its hiding and performance characteristics determined by industry consensus values.
Topcoat: the final layer of coating put onto a surface over another layer(s).

Functional Unit:

Per the reference PCR, the functional unit for the study was covering and protecting 1m^2 of substrate for a period of 60 years (the assumed lifetime of a building). The product has no additional functionalities beyond what is stated by the functional unit.

In the reference PCR, product life for resinous floor coatings was calculated both in terms of a typical market life and a technical life depending on its coating type.

Based on the guidance provided by the PCR, the coating quantities were derived for each H&C™ Shield-Crete® Water-Based Epoxy formula.

Table 5. Formula Lifetimes and Quantity of Coating Needed[2] to Satisfy Functional Unit

	Part A 20.113000	Part A 20.114000	Part A 20.115000	Part A 20.117000	Part A 20.116000	Part B 21.104600	Mixed (Part As averaged)
Product Type	Thin-mil						
Mix Ratio	4:1						
Application Setting	Commercial						
Market Lifetime (years)	10						
Technical Lifetime (years)	15						
Total Quantity Needed Market-Based Life (kg)	0.96	0.88	0.83	0.83	0.92	0.20	**1.11**
Total Quantity Needed Technical-Based Life (kg)	0.64	0.59	0.55	0.55	0.62	0.14	**0.74**
Application Setting	Industrial						
Market Lifetime (years)	5						
Technical Lifetime (years)	5						
Total Quantity Needed Market-Based Life (kg)	1.93	1.77	1.65	1.65	1.85	0.41	**2.21**
Total Quantity Needed Technical-Based Life (kg)	1.93	1.77	1.65	1.65	1.85	0.41	**2.21**

Table 6. Optional Deco-flake information and quantity needed to Satisfy Functional Unit.

	Commercial	Industrial
Coverage	1 bag covers 250 sq ft	
Market Lifetime (years)	10	5
Technical Lifetime (years)	15	5
Total Quantity Needed Market-Based Life (kg)	0.12	0.23
Total Quantity Needed Design-Based Life (kg)	0.08	0.23

[2] Value includes 2% over-purchase stipulated by reference PCR.

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Tinting:

As stated in the reference PCR, if the product was tinted at point of sale or in the field, 6 oz of colorant (thinkstep carbon black) was assumed per gallon of product.

Table 7. Tint information.

	Part A + B 20.113000	Part A + B 20.114000	Part A + B 20.115000	Part A + B 20.117000	Part A + B 20.116000
Application Setting	Commercial				
Total Quantity Needed-Market-Base Life (g)	11.16	10.27	9.63	Clear – Not tinted.	Package Color – Not tinted.
Total Quantity Needed-Technical-Base Life (g)	7.44	6.85	6.42		
Application Setting	Industrial				
Total Quantity Needed-Market-Base Life (g)	22.31	20.54	19.27	Clear – Not tinted.	Package Color – Not tinted.
Total Quantity Needed-Technical-Base Life (g)	22.31	20.54	19.27		

Allocation Rules:

In accordance with the reference PCR, allocation was avoided whenever possible, however if allocation could not be avoided, the following hierarchy of allocation methods was utilized:

- Mass, or other biophysical relationship; and
- Economic value.

In the LCA models, mass allocation was ONLY used during packaging and end of life-stages.

Treatment of Biogenic Carbon:

The reference PCR states that biogenic carbon does not need to be disclosed if there were no significant sources or impacts from the product system. There were no significant sources of biogenic carbon in these products but the Global Warming Potential (GWP) both including and excluding biogenic carbon were reported in this EPD to meet the needs of customers and align with best practices.

CO2 from calcination and carbonation, as well as, CO2 from combustion of waste from non-renewable sources used in product process are indicators listed in the PCR. These values were not recorded as they did not contribute to the Global Warming Potential due to the fact that biomaterials are not present and waste was specifically taken to landfill and not combusted.

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System Boundary:

This LCA included all relevant steps in the coating manufacturing process as described by the reference PCR. The system boundary began with the extraction of raw materials to be used in the H&C™ Shield-Crete® Water-Based Epoxy coating and its formulas are manufactured in a way similar to other architectural paint and coating products. The raw materials are manually added in appropriate quantities into a high-speed disperser which are mixed. The product is then moved via compressed air or gravity and filled into containers and shipped to a distribution center and then to the point of sale. A customer travels to the store to purchase the product and transports the coating to the site where it is applied. The applied coating adheres to the substrate where it remains until the substrate is disposed. Any unused coating will be disposed by the customer as well. Because the functional unit mandates a 60-year product life, multiple repaints were necessary and were accounted for by the LCA models. The system boundary ends with the end-of-life stage. This can be seen in Figure 1, below.

As described in the reference PCR, the following items were excluded from the assessment and they were expected to not substantially affect the results.

- personnel impacts;
- research and development activities;
- business travel;
- any secondary packaging (pallets, for example);
- all point of sale infrastructure; and
- the coating applicator.

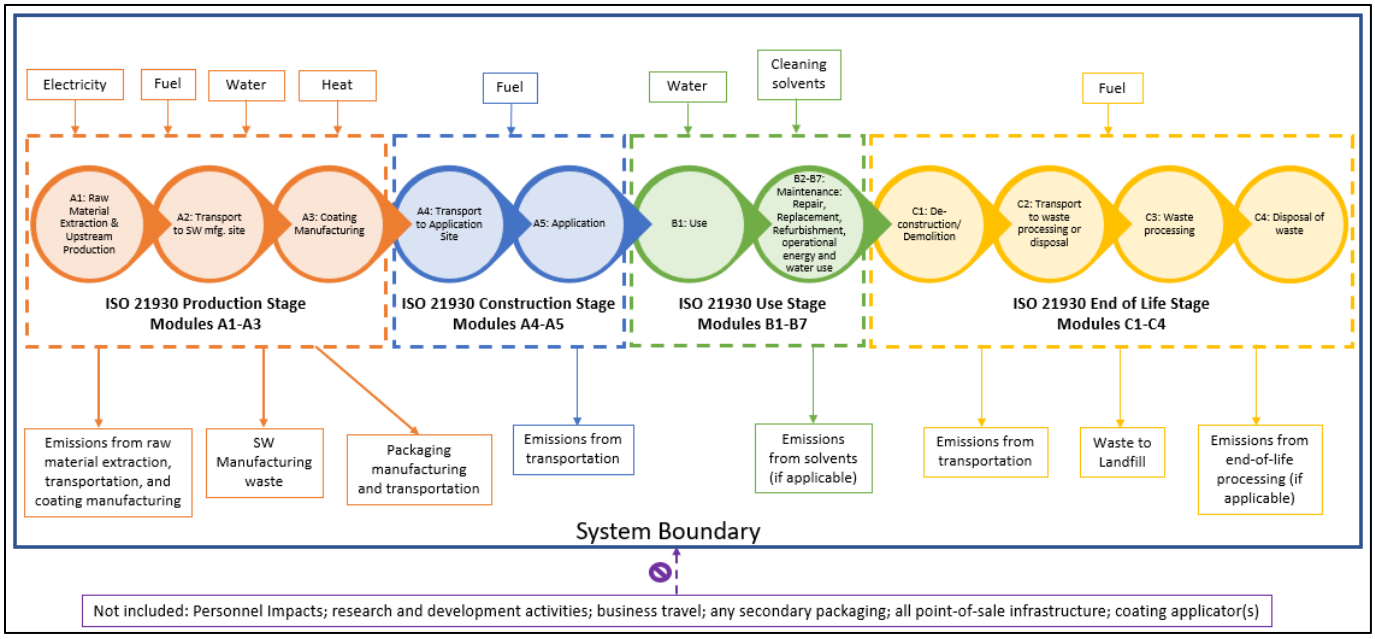

Figure 1. Diagram of System Boundary for the EPD.

Production Stage			Construction Stage		Use Stage							End-of-Life Stage				Optional supplementary info beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction/demolition	Transport	Waste processing	Disposal of waste	Potential net benefits from reuse, recycling and/or energy recovery beyond the system boundary
X	X	X	X	X	X	X	X	X	X			X	X	X	X	X*

*Assessed but results not included in totals within this EPD.

Figure 2. ISO 21930:2017 Diagram of System Boundary for the EPD.

Table 8. Transportation information:

Module	Parameter	Unit	Data Source
A2	Mode of transport	Truck	Sphera
	Transport distance of raw materials/packaging materials	miles	PCR – Table 7
A4	Mode of transport – factory to distribution center	Truck	Sphera
	Transport distance	miles	PCR – Table 8
	Mode of transport – distribution center to point of sale	Truck	Sphera
	Transport distance	miles	PCR – Table 8
	Mode of transport – factory to distribution center	Passenger car	Sphera
	Transport distance	miles	PCR – Table 8
C4	Mode of transport	Dump truck	Sphera
	Transport distance	miles	PCR – page 17

Table 9. Packaging information:

Module	Parameter	Unit	Data Source
A5	Mass of Packaging – Steel can	kg	Primary Data
	Packaging Waste – Steel can (portion recycled)	70%	USEPA WARM Model (PCR)
	Packaging Waste – Steel can (portion to landfill)	30%	USEPA WARM Model (PCR)
	GWP in biogenic carbon of steel can	-	Biogenic carbon is not present in this packaging type.
	Mass of Packaging – Plastic bag	kg	Primary data taken from products assessed and considered for this EPD.
	Mass of Packaging Waste – Plastic bag (landfill)	100%	Assumption
	GWP in biogenic carbon of plastic bag	-	Biogenic carbon is not present in this packaging type.

Cut-Off Rules:

The cut-off rules prescribed by the reference PCR required a minimum of 95% of the total mass, energy, and environmental relevance be captured by the LCA models. Any unit process shall use a maximum 1% cut-off of renewable primary resource usage, nonrenewable primary resource usage, total mass or environmental impact. All formulas that use this tool shall be modeled to at least 98% of their material content by weight in order to be eligible for verification through this tool. The formulas that were included for testing were all modeled to at least 99.7% of their material content by weight. No significant flows were excluded from the LCA models and the 5% total maximum threshold prescribed by the PCR and ISO 21930:2017 was not exceeded.

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Data Sources & Quality:

When primary data was unavailable, data was taken from either thinkstep, ecoinvent, or CEPE's coating industry life cycle inventory. The data from thinkstep and ecoinvent are widely accepted by the LCA community and the CEPE database has been built using those databases as a foundation. A brief description of these databases is below:

Table 10. Overview of Databases used in LCA Models.

Database	Comments
Sherwin-Williams	Primary source data taken as an average monthly value over a 12-month average of 2021 relevant facilities operation metrics.
thinkstep/GaBi	DB Version 10.0.0.71
ecoinvent	Version 3.3 – Most recent version available in GaBi.
CEPE LCI	Most recent version of industry LCI. Version 3.0 (2020). Made up of refined data from thinkstep and ecoinvent to make it more representative to coatings manufacturing. Primarily limited to EU data, although some processes are global.

Precision and Completeness:

Annual averages from the 2021 calendar year of primary data was used for all gate-gate processes and the most representative inventories were selected for all processes outside of Sherwin-Williams' direct operational control. Secondary data was primarily drawn from the most recent LCA for Experts/GaBi and ecoinvent databases and CEPE's 2020 coating life cycle inventory. All of these databases were assessed in terms of overall completeness.

Assumptions relating to application and disposal were conformant with the reference PCR. All data used in the LCA models was less than five years old. Pigment and resin data were taken from both ecoinvent v3.3 and LCA for Experts/GaBi databases.

Consistency and Reproducibility:

In order to ensure consistency, primary source data was used for all gate-to-gate processes in coating manufacturing. All other secondary data were applied consistently and any modifications to the databases were documented in the LCA Report.

This assessment was completed using an EPD calculator tool that has been externally verified by NSF Certification, LLC. This tool was not altered in any way from its original and verified form to generate the LCA results described in this EPD, and the results from the calculator were translated into the EPD by hand. Reproducibility is possible using the verified EPD Calculator tool or by reproducing the LCIs documented in the LCA Report.

Temporal Coverage:

Primary data was collected from the manufacturing facilities from the 2021 calendar year. Secondary data reflected the most up-do-date versions of the LCA databases mentioned above.

Geographic Coverage:

H&C™ Shield-Crete® Water-Based Epoxy is manufactured by the Sherwin-Williams Company in the United States. Given that the facilities making this product are spread across the United States, the average US grid mix was used in the LCA models. H&C™ Shield-Crete® Water-Based Epoxy products are purchased, used, and the unused portions are disposed by the customer throughout North America.

Cleaning Events:

During product application, it was assumed that the products are brush or roller applied and no impacts occurred other than the use of water for cleaning and emissions associated with the coating drying. The amount of cleaning water needed was conservatively estimated at 10% of the amount of coating applied. The amount of cleaning solution used was determined by parameters set forth in the PCR. Impacts of all cleaning events were calculated in B2. Ancillary materials were not considered as they were considered outside the system boundary by the reference PCR.

Table 11. B2 - Maintenance

	Assumption	Data Source
Cleaning Events	220 cleaning events	PCR
Cleaning Water	10% of product manufactured by weight	Estimate
Cleaning Solution	Diluted (from concentrate) cleaning solution	Estimate (Sphera dataset)

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Life Cycle Impact Assessment:

The purpose of the Life Cycle Impact Assessment (LCIA) is to show the link between the life cycle inventory results and potential environmental impacts. As such, these results are classified and characterized into several impact categories which are listed and described below. The LCIA results are relative expressions and do not predict impacts on category endpoints, exceeding of thresholds, safety margins or risks. The TRACI 2.1 method was used and the LCIA results are formatted to be conformant with the PCR, which was based on ISO 21930. The TRACI method is widely accepted for use in the US and was developed by the US EPA.

Table 12. Overview of Impact Categories[3]

Overview of LCA Impact Categories	
Impact Category Name	***Description of Impact Category***
Global Warming Potential 	*"Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities" (US Environmental Protection Agency 2008b).*
Ozone Depletion Potential 	*Ozone within the stratosphere provides protection from radiation, which can lead to increased frequency of skin cancers and cataracts in the human populations. Additionally, ozone has been documented to have effects on crops, other plants, marine life, and human-built materials. Substances which have been reported and linked to decreasing S-10637-OP-1-0 REVISION: 0 DATE: 6/22/2012 Page 13 | 24 Document ID: S-10637-OP-1-0 Date: 7/24/2012 the stratospheric ozone level are chlorofluorocarbons (CFCs) which are used as refrigerants, foam blowing agents, solvents, and halons which are used as fire extinguishing agents (US Environmental Protection Agency 2008j).*
Acidification Potential 	*Acidification is the increasing concentration of hydrogen ion (H+) within a local environment. This can be the result of the addition of acids (e.g., nitric acid and sulfuric acid) into the environment, or by the addition of other substances (e.g., ammonia) which increase the acidity of the environment due to various chemical reactions and/or biological activity, or by natural circumstances such as the change in soil concentrations because of the growth of local plant species n (US Environmental Protection Agency 2008q).*
Smog Formation Potential 	*Ground level ozone is created by various chemical reactions, which occur between nitrogen oxides (NOx) and volatile organic compounds (VOCs) in sunlight. Human health effects can result in a variety of respiratory issues including increasing symptoms of bronchitis, asthma, and emphysema. Permanent lung damage may result from prolonged exposure to ozone. Ecological impacts include damage to various ecosystems and crop damage. The primary sources of ozone precursors are motor vehicles, electric power utilities and industrial facilities (US Environmental Protection Agency 2008e).*
Eutrophication Potential 	*Eutrophication is the "enrichment of an aquatic ecosystem with nutrients (nitrates, phosphates) that accelerate biological productivity (growth of algae and weeds) and an undesirable accumulation of algal biomass" (US Environmental Protection Agency 2008d).*

[3] See EPA TRACI References for additional detail. https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci

The LCA results are reported by total, module, and grouped by stage in the remainder of this report as defined by ISO 21930.

- Total Impact (across the entire cradle-grave lifecycle including tinting if applicable)
- Product Stage (Modules A1-A3)
- Construction Stage (Modules A4-A5)
- Use Stage (Modules B1-B5)
- End-Of-Life Stage (Modules C1-C4)

No weighting or normalization was done to the results. At this time it is not recommended to weight the results of the LCA or the subsequent EPD. It is important to remember that LCA results show potential and expected impacts and these should not be used as firm thresholds/indicators of safety and/or risk. As with all scientific processes, there is uncertainty within the calculation and measurement of all impact categories and care should be taken when interpreting the results.

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Results:

The results of the LCA are shown in the tables below. The results of the impact categories were run for each formula. The Total LCIA results for the entire system were also calculated and presented in Tables 13 and 14.

Table 13. Total LCIA Results for Market Life Scenario.

Market Life	Part A 20.11300	Part A 20.11400	Part A 20.11500	Part A 20.11700	Part A 20.11600	Part B 21.104600	Deco-Flakes (averaged)	Mixed (A+B) (Part As averaged)	Mixed (A+B+Deco) (Part As & Deco-flakes averaged)
	Commercial Application								
GWP Inc Bio Carb (kg CO2e)	5.54	4.81	4.51	4.31	4.62	0.49	0.50	5.25	5.75
GWP Excl Bio Carb (kg CO2e)	5.55	4.83	4.52	4.32	4.63	0.49	0.51	5.26	5.77
Acidification (kg SO2e)	4.20E-02	2.40E-02	1.15E-02	1.11E-02	2.39E-02	1.14E-03	2.95E-02	2.36E-02	5.31E-02
Eutrophication (kg N e)	2.24E-03	2.03E-03	2.00E-03	1.97E-03	1.97E-03	1.35E-04	4.05E-04	2.18E-03	2.58E-03
Ozone Depletion (kg CFC-11e)	1.72E-08	1.80E-08	1.84E-08	1.82E-08	1.83E-08	5.69E-09	1.37E-08	2.37E-08	3.74E-08
Smog Formation (kg O3e)	0.22	0.19	0.17	0.17	0.19	2.51E-02	2.72E-02	0.21	0.24
	Industrial Application								
GWP Inc Bio Carb (kg CO2e)	9.95	8.54	7.96	7.96	8.59	0.81	1.00	9.41	10.41
GWP Excl Bio Carb (kg CO2e)	9.98	8.56	7.98	7.98	8.61	0.82	1.01	9.44	10.45
Acidification (kg SO2e)	7.34E-01	6.98E-01	6.73E-01	6.73E-01	6.98E-01	1.89E-03	5.89E-02	4.48E-02	1.04E-01
Eutrophication (kg N e)	6.58E-01	6.57E-01	6.57E-01	6.57E-01	6.57E-01	2.29E-04	8.11E-04	4.11E-03	4.92E-03
Ozone Depletion (kg CFC-11e)	6.54E-01	6.54E-01	6.54E-01	6.54E-01	6.54E-01	1.14E-08	2.74E-08	4.71E-08	7.45E-08
Smog Formation (kg O3e)	1.03	0.97	0.93	0.93	0.97	4.30E-02	5.43E-02	0.39	0.44

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Table 14. Total LCIA Results for Technical Life Scenario

Technical Life	Part A 20.11300	Part A 20.11400	Part A 20.11500	Part A 20.11700	Part A 20.11600	Part B 21.104600	Deco-Flakes (averaged)	Mixed (A+B) (Part As averaged)	Mixed (A+B+Deco) (Part As & Deco-flakes averaged)
	Commercial Application								
GWP Inc Bio Carb (kg CO2e)	9.95	8.54	7.96	7.96	8.59	0.81	0.98	9.41	10.40
GWP Excl Bio Carb (kg CO2e)	9.98	8.56	7.98	7.98	8.61	0.82	1.00	9.44	10.44
Acidification (kg SO2e)	8.15E-02	4.55E-02	2.06E-02	2.06E-02	4.62E-02	1.89E-03	5.89E-02	4.48E-02	1.04E-01
Eutrophication (kg N e)	4.26E-03	3.83E-03	3.77E-03	3.77E-03	3.78E-03	2.29E-04	8.07E-04	4.11E-03	4.92E-03
Ozone Depletion (kg CFC-11e)	3.38E-08	3.55E-08	3.64E-08	3.64E-08	3.66E-08	1.14E-08	2.74E-08	4.71E-08	7.45E-08
Smog Formation (kg O3e)	0.41	0.34	0.31	0.31	0.35	4.30E-02	5.33E-02	0.39	0.44
	Industrial Application								
GWP Inc Bio Carb (kg CO2e)	9.95	8.54	7.96	7.96	8.59	0.81	1.00	9.41	10.41
GWP Excl Bio Carb (kg CO2e)	9.98	8.56	7.98	7.98	8.61	0.82	1.01	9.44	10.45
Acidification (kg SO2e)	7.34E-01	6.98E-01	6.73E-01	6.73E-01	6.98E-01	1.89E-03	5.89E-02	4.48E-02	1.04E-01
Eutrophication (kg N e)	6.58E-01	6.57E-01	6.57E-01	6.57E-01	6.57E-01	2.29E-04	8.11E-04	4.11E-03	4.92E-03
Ozone Depletion (kg CFC-11e)	6.54E-01	6.54E-01	6.54E-01	6.54E-01	6.54E-01	1.14E-08	2.74E-08	4.71E-08	7.45E-08
Smog Formation (kg O3e)	1.03	0.97	0.93	0.93	0.97	4.30E-02	5.43E-02	0.39	0.44

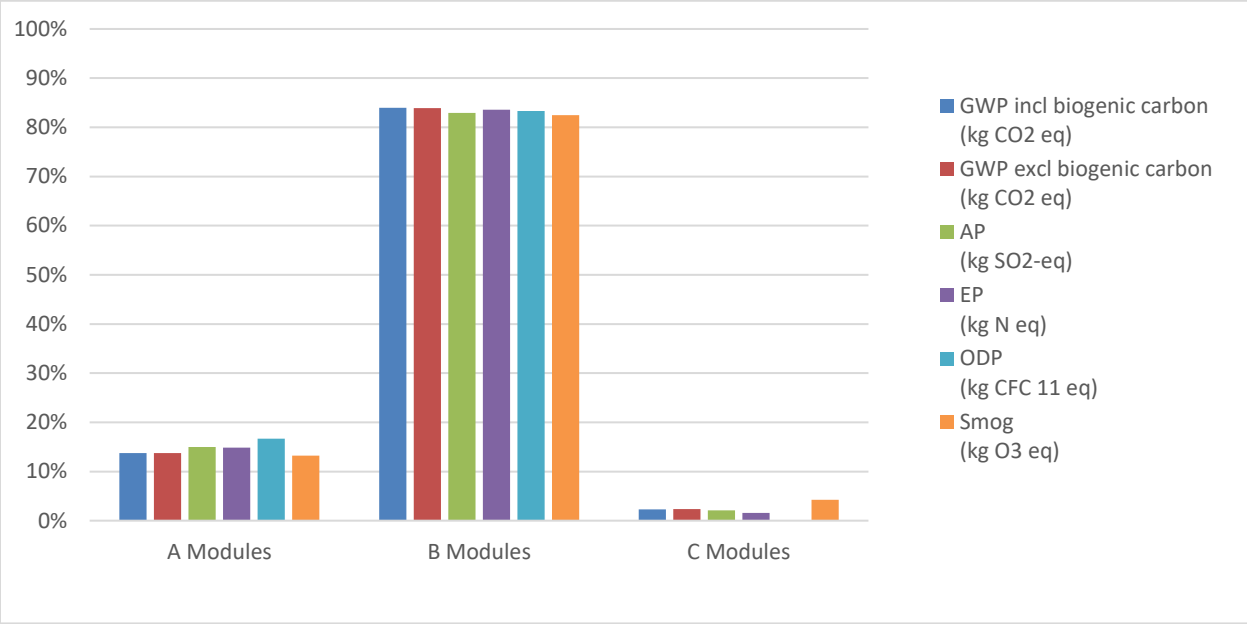

Figure 3. H&C™ Shield-Crete® Water-Based Epoxy Floor Coating LCIA Impact Distribution by ISO 21930 Modules

Resource Metrics:

Resource metrics are presented below in Table 16 and 17. Commercial and industrial applications are represented for the coating system as mixed. Specific resource metrics for an individual H&C™ Shield-Crete® Water-Based Epoxy formula are available upon request - Please contact sustainability@sherwin.com.

Table 15. Abbreviations used in Resource Metrics results.

Abbreviation	Full Description
ADP	abiotic depletion potential
$NRPR_E$	non-renewable primary resources used as an energy carrier (fuel)
$NRPR_M$	non-renewable primary resources with energy content used as materials
RPR_E	renewable primary resources used as an energy carrier (fuel)
RPR_M	renewable primary energy resources with energy content used as material
Opt	Optional supplementary info beyond the system boundary

The following resource metrics were assessed but the impact result was zero. These were excluded from the resource metric tables.

- Recovered Energy from disposal of waste in previous systems (MJ)
- Secondary material (kg)
- Recycled material (kg)
- Renewable secondary fuels (MJ)
- Non-renewable secondary fuels (MJ)

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Table 16. Resource Metrics for Commercial Application. H&C™ Shield-Crete® Water-Based Epoxy resinous flooring system as mixed (4 Parts A: 1 Part B + Decoflakes)

Commercial Application			$NRPR_E$ (MJ)[4]	$NRPR_M$ (kg)	RPR_E (MJ)[5]	RPR_M (KG)	ADP for Fossil Resources Used as Energy (MJ)	ADP for Fossil Resources Used as Materials (kg)	Consumption of Freshwater (m^3)	Hazardous waste (kg)	Non-hazardous waste (kg)	High-level radioactive waste (kg)	Intermediate and low-level radioactive waste (kg)
Market	Product Stage	A1	13.07	0.73	0.39	207.51	10.97	2.98E-06	0.12	0.00	0.00	1.42E-07	3.60E-06
		A2	1.11	6.79E-03	4.26E-02	3.34	1.02	1.32E-08	1.92E-04	0.00	0.00	2.25E-09	6.00E-08
		A3	0.36	3.73E-02	5.38E-02	16.30	0.26	4.52E-09	1.29E-04	5.57E-04	0.00	3.62E-08	9.98E-07
	Construction Stage	A4	6.28	0.16	0.70	21.51	5.91	7.70E-08	1.54E-03	0.00	0.00	3.04E-09	8.13E-08
		A5	0.85	0.27	9.47E-02	22.85	0.78	2.08E-08	1.11E-04	0.00	1.26E-03	1.98E-09	4.71E-08
	Use Stage	B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		B2	14.20	1.97	1.31	406.00	11.4	9.58E-06	1.45E-02	0.00	0.00	8.35E-07	2.31E-05
		B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		B4	108.32	6.07	6.40	1357.57	94.71	1.55E-05	0.62	2.78E-03	6.32E-03	9.27E-07	2.39E-05
		B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	End-of-Life Stage	C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C2	0.30	1.88E-03	1.18E-02	0.93	0.28	3.64E-09	5.30E-05	0.00	0.00	6.18E-10	1.65E-08
		C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C4	0.91	0.31	6.83E-02	24.29	0.83	2.06E-08	1.20E-04	0.00	7.58E-03	8.32E-09	2.20E-07
	Opt	D	-0.80	-0.24	7.15E-02	35.60	-0.82	-1.76E-07	-3.93E-04	0.00	0.00	3.56E-11	8.52E-10
Technical	Product Stage	A1	13.07	0.73	0.39	207.51	10.97	2.98E-06	0.12	0.00	0.00	1.42E-07	3.60E-06
		A2	1.11	6.79E-03	4.26E-02	3.34	1.02	1.32E-08	1.92E-04	0.00	0.00	2.25E-09	6.00E-08
		A3	0.36	3.73E-02	5.38E-02	16.30	0.26	4.52E-09	1.29E-04	5.57E-04	0.00	3.62E-08	9.98E-07
	Construction Stage	A4	1.18	0.13	0.45	4.06	1.20	1.56E-08	3.12E-04	0.00	0.00	3.04E-09	8.13E-08
		A5	0.16	6.44E-02	5.11E-02	4.30	0.16	4.22E-09	2.25E-05	0.00	1.26E-03	1.98E-09	4.71E-08
	Use Stage	B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		B2	14.20	1.97	1.31	406.00	11.40	0.00	0.01	0.00	0.00	8.35E-07	2.31E-05
		B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		B4	47.65	2.90	2.98	706.54	40.84	9.05E-06	0.37	1.67E-03	3.79E-03	5.56E-07	1.44E-05
		B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	End-of-Life Stage	C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C2	0.20	1.25E-03	7.86E-03	0.62	0.19	2.43E-09	3.53E-05	0.00	0.00	4.12E-10	1.10E-08
		C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C4	0.61	0.20	4.55E-02	16.20	0.55	1.37E-08	7.98E-05	0.00	5.06E-03	5.54E-09	1.46E-07
	Opt	D	-0.53	-0.16	4.76E-02	23.74	-0.55	-1.17E-07	-2.62E-04	0.00	0.00	2.37E-11	5.68E-10

For simplicity within this report the resource metrics table above reflects a worst-case (highest impact) flooring system within this product line.

[4] $NRPR_E$ includes fossil energy and nuclear energy.

[5] RPR_E includes biomass, hydropower, solar, wind power, and other sources.

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Table 15. Resource Metrics for Industrial Application. H&C™ Shield-Crete® Water-Based Epoxy resinous flooring system as mixed (4 Parts A: 1 Part B + Decoflakes).

Industrial Application			$NRPR_E$ (MJ)[6]	$NRPR_M$ (kg)	RPR_E (MJ)[7]	RPR_M (KG)	ADP for Fossil Resources Used as Energy (MJ)	ADP for Fossil Resources Used as Materials (kg)	Consumption of Freshwater (m^3)	Hazardous waste (kg)	Non-hazardous waste (kg)	High-level radioactive waste (kg)	Intermediate and low-level radioactive waste (kg)
Market/Technical Life	Product Stage	A1	13.07	0.73	0.39	207.51	10.97	2.98E-06	0.12	0.00	0.00	1.42E-07	3.60E-06
		A2	1.11	6.79E-03	4.26E-02	3.34	1.02	1.32E-08	1.92E-04	0.00	0.00	2.25E-09	6.00E-08
		A3	0.36	3.73E-02	5.38E-02	16.30	0.26	4.52E-09	1.29E-04	5.57E-04	0.00	3.62E-08	9.98E-07
	Construction Stage	A4	1.18	0.13	0.45	4.06	1.20	1.56E-08	3.12E-04	0.00	0.00	3.04E-09	8.13E-08
		A5	0.16	6.44E-02	5.11E-02	4.30	0.16	4.22E-09	2.25E-05	0.00	1.26E-03	1.98E-09	4.71E-08
	Use Stage	B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		B2	14.20	1.97	1.31	406.00	11.40	0.00	0.01	0.00	0.00	0.00	0.00
		B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		B4	174.72	10.64	10.94	2590.63	149.76	0.00	1.35	6.13E-03	1.39E-02	2.04E-06	5.27E-05
		B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	End-of-Life Stage	C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C2	0.61	3.75E-03	2.36E-02	1.86	0.57	7.28E-09	1.06E-04	0.00	0.00	1.24E-09	3.31E-08
		C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		C4	1.83	0.61	0.14	48.59	1.65	4.11E-08	2.39E-04	0.00	1.52E-02	1.66E-08	4.39E-07
	Opt	D	-1.60	-0.48	0.14	71.21	-1.64	-3.52E-07	-7.87E-04	0.00	0.00	7.12E-11	1.70E-09

For simplicity within this report the resource metrics table above reflects a worst-case (highest impact) flooring system within this product line.

[6] $NRPR_E$ includes fossil energy and nuclear energy.
[7] RPR_E includes biomass, hydropower, solar, wind power, and other sources.

Interpretation:

The majority of the environmental impact was from the raw materials used to make the coatings (Module A1) and which are also reflected in the repaints required to satisfy the functional unit (Module B4). The raw materials with the largest impacts were the resins and additives. This was not surprising given the amount of resources needed to manufacture these intermediate products and also that these raw materials represent a substantial portion of the system formulation.

Since the raw materials were responsible for the largest portion of the impact that the manufacturer could potentially optimize, product performance and durability were important. Within the flooring system, there is a range in how much coating is needed to satisfy the functional unit depending on the market and technical life. A higher volume of coating needed would often result in higher impacts.

Generally speaking, the longer a coating lasts, the better its environmental performance will be. Ultimately, the end-user should decide which lifetime is more appropriate for their decision-making.

Study Completeness:

Completeness estimates are somewhat subjective, as it is impossible for any LCA or inventory to be 100% complete. However, based on expert judgment, it is believed that given the overall data quality that the study is at least 95% complete. As such, at least 95% of system mass, energy, and environmental relevance were covered.

Uncertainty:

Because a large number of data sets are linked together in the LCA models, it is unknown how much of the data sets have goals that are dissimilar to this LCA. As such, it is difficult to estimate overall uncertainty of the LCA models. However, primary source data was used whenever possible and the most appropriate secondary data sources were used throughout the models. The Sphera/thinkstep and ecoinvent databases are widely accepted by the LCA community and CEPE's LCI Database is based off Sphera/thinkstep and ecoinvent data, just being optimized/corrected for coating manufacturing processes.

Since the reference PCR stipulated the majority of the crucial LCA assumptions, Sherwin-Williams is comfortable with the methodology of the LCA and feel they reflect current best-practices.

Limitations:

LCA is not a perfect tool for comparisons and impact values are constantly changing due to shifts in the grid mix, transportation, fuels, etc. Because of this, care should be taken when applying or interpreting these results. This being said, the relative impacts between products should be more reliable and less sensitive versus the specific impact category and metric values.

There were cases where analogue chemicals had to be used in the LCA models. This occurred when no LCI data was available for an intermediate chemical/material. This was typically limited to additives representing a small amount of the overall formula but may still impact the results. Likewise, there were cases where data had to be used from a different region or technology. These instances were uncommon and were not expected to have a serious effect on the results, but still may limit the study.

Emissions to Water, Soil, and to Indoor Air:

VOC determination was done using the federally accepted methods outlined by the EPA in the Federal Register. Additional information on VOCs can be found on the product data sheets for the specific formula on www.hcconcrete.com.

The method for VOC determination was calculated in accordance with EU Directive 2004/42/EC.

Critical Review:

Since the goal of the LCA was to generate an EPD, it was submitted for review by NSF Certification, LLC. NSF has commissioned Mr. Jack Geibig of EcoForm to conduct the formal review of the LCA report.

Additional Environmental Information:

VOC Content			
Part A – Extra White	20.113000	<50 g/L	Determined by *EPA VOC Regulatory Calculation*
Part A – Deep Base	20.114000	<50 g/L	
Part A – Ultra Deep Base	20.115000	<50 g/L	
Part A – Clear	20.117000	<50 g/L	
Part A – Concrete Gray	20.116000	<50 g/L	
Part B	21.104600	<50 g/L	

Preferred End-of Life Options for this product line:

Unused product should be taken to an appropriate waste disposal center. See product label for details. Never place unused product down any indoor or outdoor drain. Safe and proper disposal of excess materials shall be done in accordance with applicable federal, state, and local codes.

References:

ASTM International, West Conshohocken, PA, 2014, www.astm.org

American Coating Association Product Category Rule for Resinous Floor Coatings. Available at via NSF International. Published December 2018. https://www.nsf.org/standards-development/product-category-rules

EPA VOC Calculation Rules. https://www.epa.gov/stationary-sources-air-pollution/consumer-products-national-volatile-organic-compound-emission

ISO 14025:2006 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures.*

ISO 14040:2006 *Environmental management - Life cycle assessment – Principles and framework.*

ISO 14044:2006 *Environmental management - Life cycle assessment – Requirements and guidelines.*

ISO 21930:2017 *Sustainability in building construction – Environmental declaration of building products.*

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Appendix A: LCIA Results by ISO Module – Commercial Application – Market Life.

Commercial Application – Market Life															
Life Cycle Stage:	**Product Stage**			**Construction Stage**		**Use Stage**					**End-of-Life Stage**				**Opt**
Module:	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**D**
Part A															
GWP Inc Bio Carb (kg CO2e)	0.54	5.18E-02	1.47E-02	6.21E-02	7.30E-03	0.00	-	0.00	3.38	0.00	0.00	1.37E-02	0.00	3.56E-02	-5.86E-02
GWP Excl Bio Carb (kg CO2e)	0.54	5.21E-02	1.47E-02	6.33E-02	7.44E-03	0.00	-	0.00	3.39	0.00	0.00	1.38E-02	0.00	3.73E-02	-5.85E-02
Acidification (kg SO2e)	3.12E-03	1.46E-04	2.23E-05	1.41E-04	3.37E-05	0.00	-	0.00	1.73E-02	0.00	0.00	3.98E-05	0.00	1.65E-04	-1.00E-04
Eutrophication (kg N e)	2.69E-04	1.74E-05	1.69E-06	2.00E-05	1.83E-06	0.00	-	0.00	1.55E-03	0.00	0.00	4.70E-06	0.00	9.30E-06	-8.00E-06
Ozone Depletion (kg CFC-11e)	3.00E-09	5.55E-18	7.07E-17	7.42E-18	1.24E-15	0.00	-	0.00	1.50E-08	0.00	0.00	1.47E-18	0.00	1.22E-16	-1.37E-16
Smog Formation (kg O3e)	1.61E-02	4.66E-03	3.18E-04	4.41E-03	7.24E-04	0.00	-	0.00	1.31E-01	0.00	0.00	8.94E-04	0.00	2.90E-03	-9.74E-04
Part B															
GWP Inc Bio Carb (kg CO2e)	2.24E-02	1.14E-02	3.24E-03	1.37E-02	1.61E-03	0.00	-	0.00	0.26	0.00	0.00	3.15E-03	0.00	8.18E-03	-1.35E-02
GWP Excl Bio Carb (kg CO2e)	2.24E-02	1.15E-02	3.24E-03	1.40E-02	1.64E-03	0.00	-	0.00	0.26	0.00	0.00	3.17E-03	0.00	8.56E-03	-1.34E-02
Acidification (kg SO2e)	4.24E-05	3.23E-05	4.91E-06	3.10E-05	7.42E-06	0.00	-	0.00	5.90E-04	0.00	0.00	9.15E-06	0.00	3.78E-05	-2.30E-05
Eutrophication (kg N e)	6.10E-06	3.83E-06	3.73E-07	4.41E-06	4.03E-07	0.00	-	0.00	7.56E-05	0.00	0.00	1.08E-06	0.00	2.14E-06	-1.84E-06
Ozone Depletion (kg CFC-11e)	9.49E-10	1.22E-18	1.56E-17	1.64E-18	2.74E-16	0.00	-	0.00	4.75E-09	0.00	0.00	3.38E-19	0.00	2.81E-17	-3.15E-17
Smog Formation (kg O3e)	6.20E-04	1.03E-03	7.02E-05	9.73E-04	1.54E-04	0.00	-	0.00	1.42E-02	0.00	0.00	2.05E-04	0.00	6.67E-04	-2.24E-04
Mixed (4:1 + decoflakes)															
GWP Inc Bio Carb (kg CO2e)	0.63	6.98E-02	1.98E-02	8.35E-02	9.84E-03	0.00	0.82	0.00	4.05	0.00	0.00	1.87E-02	0.00	4.85E-02	-7.98E-02
GWP Excl Bio Carb (kg CO2e)	0.63	7.02E-02	1.98E-02	8.52E-02	1.00E-02	0.00	0.82	0.00	4.07	0.00	0.00	1.88E-02	0.00	5.08E-02	-7.97E-02
Acidification (kg SO2e)	8.02E-03	1.97E-04	3.00E-05	1.89E-04	4.54E-05	0.00	1.91E-03	0.00	4.24E-02	0.00	0.00	5.43E-05	0.00	2.24E-04	-1.36E-04
Eutrophication (kg N e)	3.38E-04	2.34E-05	2.28E-06	2.69E-05	2.47E-06	0.00	2.08E-04	0.00	1.96E-03	0.00	0.00	6.40E-06	0.00	1.27E-05	-1.09E-05
Ozone Depletion (kg CFC-11e)	6.24E-09	7.48E-18	9.53E-17	9.98E-18	1.68E-15	0.00	2.40E-15	0.00	3.12E-08	0.00	0.00	2.00E-18	0.00	1.66E-16	-1.87E-16
Smog Formation (kg O3e)	1.99E-02	6.28E-03	4.29E-04	5.94E-03	9.67E-04	0.00	3.57E-02	0.00	0.17	0.00	0.00	1.22E-03	0.00	3.96E-03	-1.33E-03

- B2-cleaning is only reported in the "mixed" results since the cleaning applies to the coating system (flooring surface is cleaned) and not individual parts.
- Due to the multiple Part A Options, Part A results were averaged.
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Appendix B: LCIA Results by ISO Module – Commercial Application – Technical Life.

Commercial Application – Technical Life															
Life Cycle Stage:	**Product Stage**			**Construction Stage**		**Use Stage**					**End-of-Life Stage**				**Opt**
Module:	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**D**
Part A															
GWP Inc Bio Carb (kg CO2e)	0.53	5.11E-02	1.45E-02	6.12E-02	7.21E-03	0.00	-	0.00	2.16	0.00	0.00	1.12E-02	0.00	2.92E-02	-3.91E-02
GWP Excl Bio Carb (kg CO2e)	0.53	5.14E-02	1.45E-02	6.25E-02	7.34E-03	0.00	-	0.00	2.17	0.00	0.00	1.13E-02	0.00	3.06E-02	-3.90E-02
Acidification (kg SO2e)	3.10E-03	1.44E-04	2.20E-05	1.39E-04	3.32E-05	0.00	-	0.00	1.07E-02	0.00	0.00	3.27E-05	0.00	1.35E-04	-6.67E-05
Eutrophication (kg N e)	2.69E-04	1.71E-05	1.67E-06	1.97E-05	1.81E-06	0.00	-	0.00	9.73E-04	0.00	0.00	3.85E-06	0.00	7.62E-06	-5.34E-06
Ozone Depletion (kg CFC-11e)	3.00E-09	5.48E-18	6.98E-17	7.32E-18	1.23E-15	0.00	-	0.00	1.18E-08	0.00	0.00	1.20E-18	0.00	1.00E-16	-9.15E-17
Smog Formation (kg O3e)	1.60E-02	4.60E-03	3.14E-04	4.35E-03	7.15E-04	0.00	-	0.00	8.66E-02	0.00	0.00	7.33E-04	0.00	2.38E-03	-6.49E-04
Part B															
GWP Inc Bio Carb (kg CO2e)	2.24E-02	1.14E-02	3.24E-03	1.37E-02	1.61E-03	0.00	-	0.00	1.21E-03	0.00	0.00	2.10E-03	0.00	5.45E-03	-8.98E-03
GWP Excl Bio Carb (kg CO2e)	2.24E-02	1.15E-02	3.24E-03	1.40E-02	1.64E-03	0.00	-	0.00	1.22E-03	0.00	0.00	2.12E-03	0.00	5.71E-03	-8.96E-03
Acidification (kg SO2e)	4.24E-05	3.23E-05	4.91E-06	3.10E-05	7.42E-06	0.00	-	0.00	3.51E-06	0.00	0.00	6.10E-06	0.00	2.52E-05	-1.53E-05
Eutrophication (kg N e)	6.10E-06	3.83E-06	3.73E-07	4.41E-06	4.03E-07	0.00	-	0.00	4.15E-07	0.00	0.00	7.20E-07	0.00	1.42E-06	-1.23E-06
Ozone Depletion (kg CFC-11e)	9.49E-10	1.22E-18	1.56E-17	1.64E-18	2.74E-16	0.00	-	0.00	1.30E-19	0.00	0.00	2.25E-19	0.00	1.87E-17	-2.10E-17
Smog Formation (kg O3e)	6.20E-04	1.03E-03	7.02E-05	9.73E-04	1.54E-04	0.00	-	0.00	7.89E-05	0.00	0.00	1.37E-04	0.00	4.45E-04	-1.49E-04
Mixed (4:1 + decoflakes)															
GWP Inc Bio Carb (kg CO2e)	0.62	6.91E-02	1.96E-02	8.27E-02	9.74E-03	0.00	0.82	0.00	2.41	0.00	0.00	1.25E-02	0.00	3.23E-02	-5.32E-02
GWP Excl Bio Carb (kg CO2e)	0.62	6.95E-02	1.96E-02	8.43E-02	9.93E-03	0.00	0.82	0.00	2.42	0.00	0.00	1.25E-02	0.00	3.38E-02	-5.31E-02
Acidification (kg SO2e)	8.01E-03	1.95E-04	2.97E-05	1.88E-04	4.49E-05	0.00	1.91E-03	0.00	2.54E-02	0.00	0.00	3.62E-05	0.00	1.50E-04	-9.08E-05
Eutrophication (kg N e)	3.37E-04	2.32E-05	2.26E-06	2.66E-05	2.44E-06	0.00	2.08E-04	0.00	1.17E-03	0.00	0.00	4.27E-06	0.00	8.44E-06	-7.27E-06
Ozone Depletion (kg CFC-11e)	6.23E-09	7.40E-18	9.44E-17	9.88E-18	1.66E-15	0.00	2.40E-15	0.00	1.87E-08	0.00	0.00	1.33E-18	0.00	1.11E-16	-1.25E-16
Smog Formation (kg O3e)	1.98E-02	6.21E-03	4.25E-04	5.88E-03	9.58E-04	0.00	3.57E-02	0.00	0.10	0.00	0.00	8.12E-04	0.00	2.64E-03	-8.84E-04

- B2-cleaning is only reported in the "mixed" results since the cleaning applies to the coating system (flooring surface is cleaned) and not individual parts.
- Due to the multiple Part A Options, Part A results were averaged.
- Opt = Optional supplementary info beyond the system boundary

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Appendix C: LCIA Results by ISO Module – Industrial Application – Market/Technical Life

Industrial Application – Market Life/Technical Life															
Life Cycle Stage:	**Product Stage**			**Construction Stage**		**Use Stage**					**End-of-Life Stage**				**Opt**
Module:	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**D**
Part A															
GWP Inc Bio Carb (kg CO2e)	0.52	4.97E-02	1.41E-02	5.96E-02	7.01E-03	0.00	-	0.00	7.19	0.00	0.00	2.74E-02	0.00	7.12E-02	-0.12
GWP Excl Bio Carb (kg CO2e)	0.52	5.00E-02	1.41E-02	6.08E-02	7.14E-03	0.00	-	0.00	7.21	0.00	0.00	2.76E-02	0.00	7.45E-02	-0.12
Acidification (kg SO2e)	3.08E-03	1.40E-04	2.14E-05	1.35E-04	3.23E-05	0.00	-	0.00	3.75E-02	0.00	0.00	7.97E-05	0.00	3.29E-04	-2.00E-04
Eutrophication (kg N e)	2.68E-04	1.67E-05	1.62E-06	1.92E-05	1.76E-06	0.00	-	0.00	3.38E-03	0.00	0.00	9.40E-06	0.00	1.86E-05	-1.60E-05
Ozone Depletion (kg CFC-11e)	2.98E-09	5.33E-18	6.79E-17	7.13E-18	1.19E-15	0.00	-	0.00	3.28E-08	0.00	0.00	2.94E-18	0.00	2.44E-16	-2.74E-16
Smog Formation (kg O3e)	1.59E-02	4.47E-03	3.05E-04	4.23E-03	6.71E-04	0.00	-	0.00	0.28	0.00	0.00	1.79E-03	0.00	5.81E-03	-1.95E-03
Part B															
GWP Inc Bio Carb (kg CO2e)	2.24E-02	1.14E-02	3.24E-03	1.37E-02	1.61E-03	0.00	-	0.00	0.58	0.00	0.00	6.30E-03	0.00	1.64E-02	-2.69E-02
GWP Excl Bio Carb (kg CO2e)	2.24E-02	1.15E-02	3.24E-03	1.40E-02	1.64E-03	0.00	-	0.00	0.58	0.00	0.00	6.35E-03	0.00	1.71E-02	-2.69E-02
Acidification (kg SO2e)	4.24E-05	3.23E-05	4.91E-06	3.10E-05	7.42E-06	0.00	-	0.00	1.30E-03	0.00	0.00	1.83E-05	0.00	7.57E-05	-4.60E-05
Eutrophication (kg N e)	6.10E-06	3.83E-06	3.73E-07	4.41E-06	4.03E-07	0.00	-	0.00	1.66E-04	0.00	0.00	2.16E-06	0.00	4.27E-06	-3.68E-06
Ozone Depletion (kg CFC-11e)	9.49E-10	1.22E-18	1.56E-17	1.64E-18	2.74E-16	0.00	-	0.00	1.04E-08	0.00	0.00	6.75E-19	0.00	5.61E-17	-6.30E-17
Smog Formation (kg O3e)	6.20E-04	1.03E-03	7.02E-05	9.73E-04	1.54E-04	0.00	-	0.00	3.13E-02	0.00	0.00	4.11E-04	0.00	1.33E-03	-4.47E-04
Mixed (4:1 + decoflakes)															
GWP Inc Bio Carb (kg CO2e)	0.61	6.77E-02	1.92E-02	8.11E-02	9.55E-03	0.00	0.82	0.00	8.67	0.00	0.00	3.74E-02	0.00	9.69E-02	-0.16
GWP Excl Bio Carb (kg CO2e)	0.61	6.81E-02	1.92E-02	8.27E-02	9.73E-03	0.00	0.82	0.00	8.71	0.00	0.00	3.76E-02	0.00	1.02E-01	-0.16
Acidification (kg SO2e)	7.99E-03	1.91E-04	2.91E-05	1.84E-04	4.40E-05	0.00	1.91E-03	0.00	9.28E-02	0.00	0.00	1.09E-04	0.00	4.49E-04	-2.73E-04
Eutrophication (kg N e)	3.36E-04	2.27E-05	2.21E-06	2.61E-05	2.39E-06	0.00	2.08E-04	0.00	4.29E-03	0.00	0.00	1.28E-05	0.00	2.53E-05	-2.18E-05
Ozone Depletion (kg CFC-11e)	6.21E-09	7.26E-18	9.24E-17	9.69E-18	1.63E-15	0.00	2.40E-15	0.00	6.83E-08	0.00	0.00	4.00E-18	0.00	3.33E-16	-3.74E-16
Smog Formation (kg O3e)	1.97E-02	6.09E-03	4.16E-04	5.77E-03	9.14E-04	0.00	3.57E-02	0.00	0.36	0.00	0.00	2.44E-03	0.00	7.91E-03	-2.65E-03

- B2-cleaning is only reported in the "mixed" results since the cleaning applies to the coating system (flooring surface is cleaned) and not individual parts.
- Due to the multiple Part A Options, Part A results were averaged.
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