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Environmental Product Declaration – H&C™ 100% Solids Self-Levelling Epoxy[1]

Certified Environmental Product Declaration
www.nsf.org

H&C™ 100% Solids Self-Levelling Epoxy is a 100% solids, two-component, self-leveling clear epoxy. It was formulated to create a durable, low-maintenance flooring surface, and can be used over H&C® concrete color treatments.

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™ 100% Solids Self-Levelling Epoxy formulas is shown in Table 1 on page 2 of the EPD.

Declaration Holder	The Sherwin-Williams Company (sustainability@sherwin.com)
Declaration Number	EPD10922
Declared Product	H&C™ 100% Solids Self-Levelling 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™ 100% Solids Self-Levelling Epoxy is a resinous floor coating manufactured by The Sherwin-Williams Company, headquartered in Cleveland, Ohio. H&C™ 100% Solids Self-Levelling 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™ 100% Solids Self-Levelling 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™ 100% Solids Self-Levelling Epoxy products listed below are included within this assessment. The product system consists of a Part A base and a Part B hardener. For information on other attributes of each of the specific formulations, please visit www.hcconcrete.com.

Table 1. List of H&C™ 100% Solids Self-Levelling Epoxy Formulas Assessed by LCA Model and Report.

Product ID for EPD	**Product Numbers Included**		**Product Info**
50.18065A	50.18065A-16	1 Gallon	High Gloss Part A
	50.18045A-20	5 Gallon	
50.18065B	50.18065B-16	1 Gallon	High Gloss Part B
	50.18045B-20	5 Gallon	
Mix Ratio- 2 Gallon Part A: 1 Gallon Part B (**2:1**)			

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Under the Product Category Rule (PCR) for Resinous Floor Coatings, H&C™ 100% Solids Self-Levelling 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™ 100% Solids Self-Levelling Epoxy resinous floor coating system (as mixed) is shown below.

- Resins (60%-70%)
- Solvents (10%-20%)
- Extender Pigments (0%)
- Additives (20%-30%)

Table 2. List of Hazardous ingredients in H&C™ 100% Solids Self-Levelling Epoxy Formulas.

	Ingredient	Percentage	CAS #
Part A	Epoxy Polymer	≥75 - ≤90	1675-54-3
	1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-, polymer with 2-(chloromethyl) oxirane	≤10	30499-70-8
	Phenylmethanol	≤5	100-51-6
	Phenol, 4-Nonyl-, Branched	<1	84852-15-3
Part B	Phenylmethanol	≥25 - ≤45	100-51-6
	Isophorone Diamine	≥25 - ≤50	2855-13-2
	Phenol, 4-Nonyl-, Branched	≥10 - ≤25	84852-15-3
	Phenol, 2-nonyl-, branched	≤3	91672-41-2

Other than the materials listed above in Table 2, 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. For additional information about product hazards, please refer to the Safety Data Sheet for the specific H&C™ 100% Solids Self-Levelling Epoxy formula available on www.hcconcrete.com.

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Table 3. Typical Physical Properties for H&C™ 100% Solids Self-Levelling Epoxy flooring system.

PHYSICAL PROPERTIES

Physical Properties and Characteristics		
Property	**Test Method**	**Value**
Dry Time (@ 72°F, 50% RH at 10 mils (250 microns)*	Dry-to-touch	6 to 12 hours
	Light foot traffic	24 hours
	Heavy traffic	72 hours
	Recoat**	8 to 24 hours
	Full cure	7 days
Pot Life		40 mins.
VOC	EPA Method 24	<100 g/L; .83 lbs/gal as applied
Static Coefficient of Friction	NFSI Method B101.3-2012 and B101.1-2009	With SharkGrip: Wet SCOF .969 Wet DCOF .751 Without SharkGrip: Wet SCOF .991 Wet DCOF .724
Finish		High Gloss
Abrasion Resistance	ASTM D4060, CS17 wheel, 1,000 cycles	76 mg loss
Flammability	24 hours	Self-extinguishing over concrete
Flexural Strength	ASTM D790	~12,400 psi
Tensile Strength	ASTM D 638	3527.4 psi
Impact Resistance	MIL-D 3134J	Direct: 160 in-lb Reverse: 20 in-lb
Hardness, Shore D	ASTM D 2240	77
Adhesion	ACI 503R	300 psi concrete failure
Volume Solids		98% ± 2%
Weight Solids		98% ± 2%
Weight per Gallon		10.3 lbs. ± 0.2 lb/gal
Shelf Life***	Unopened	Part A: 36 months Part B: 24 months

*Drying times are temperature, humidity and film-thickness dependent.
**If maximum recoat time is exceeded, abrade the surface before recoating.
***Store indoors at 40°F (4.5° C) to 100°F (38° C).

Coverage	**50 - 160 sq ft**
Thickness	30 – 10 mils (wet)
Coverage rate used for EPD	100 sq ft

See PDS for additional technical information.
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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™ 100% Solids Self-Levelling 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™ 100% Solids Self-Levelling 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).

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Underlying Life Cycle Assessment Methodology:

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, as well as commercial and industrial applications.

Based on the guidance provided by the PCR, the coating quantities were derived for each H&C™ 100% Solids Self-Levelling Epoxy formula.

Table 4. Formula Lifetimes and Quantity of Coating Needed[2] to Satisfy Functional Unit

	Part A	Part B	Mixed
Product Type	Thin-mil		
Mix Ratio	2:1		
Application Setting	Commercial		
Market Lifetime (years)	10		
Technical Lifetime (years)	15		
Total Quantity Needed using Market-Based Life (kg)	1.87	0.81	**2.68**
Total Quantity Needed using Technical-Based Life (kg)	1.25	0.54	**1.79**
Application Setting	Industrial		
Market Lifetime (years)	5		
Technical Lifetime (years)	5		
Total Quantity Needed using Market-Based Life (kg)	3.74	1.62	**5.36**
Total Quantity Needed using Technical-Based Life (kg)	3.74	1.62	**5.36**

[2] Values include 2% over-purchase stipulated by reference PCR.

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. Tinting does not apply to the product system assessed in this EPD.

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.

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™ 100% Solids Self-Levelling 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.

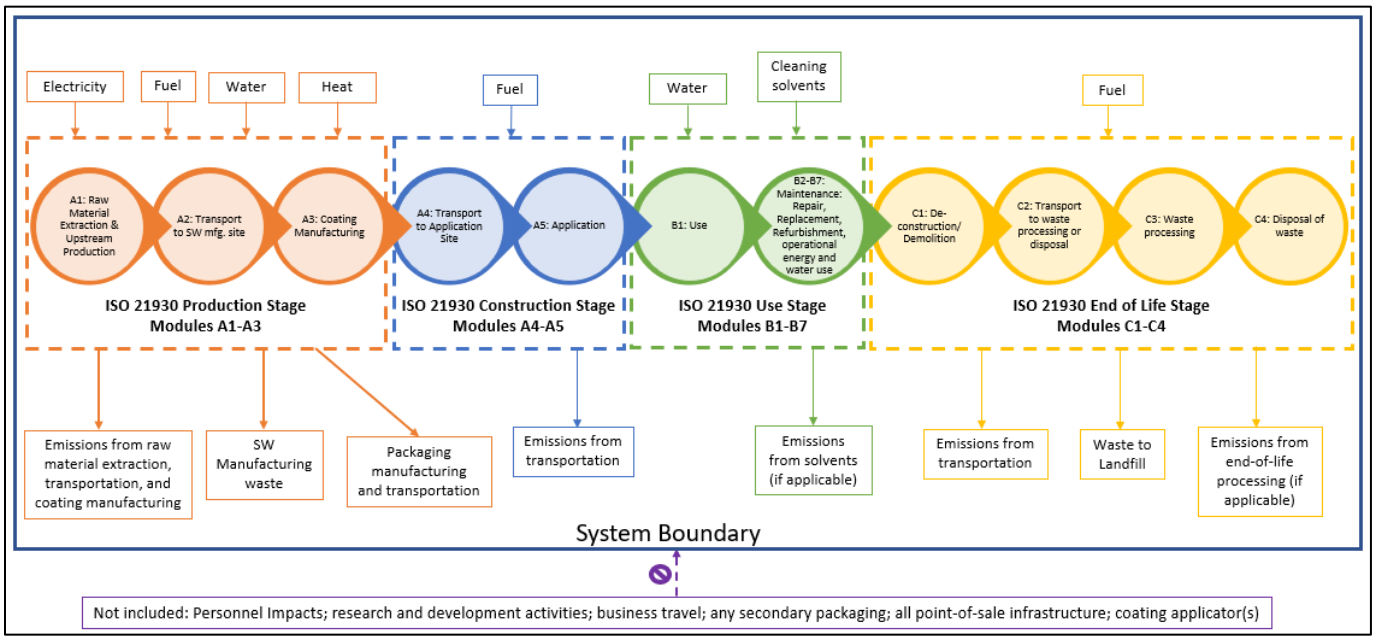

Figure 1. Diagram of System Boundary for the EPD.

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.

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Table 5. 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 6. 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.

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 Sphera/thinkstep, ecoinvent, or CEPE's coating industry life cycle inventory. The data from Sphera/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 7. 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™ 100% Solids Self-Levelling 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™ 100% Solids Self-Levelling 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 8. 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 9. Overview of Impact Categories[3]

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.

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, market and technical life, were also calculated and presented in Table 10 for both commercial and industrial applications.

Table 10. Total LCIA Results for Commercial and Industrial Application.

	Part A	Part B	Mixed
	Commercial Application – Market Life		
GWP Inc Bio Carb (kg CO2e)	17.81	3.49	21.30
GWP Excl Bio Carb (kg CO2e)	17.83	3.55	21.39
Acidification (kg SO2e)	4.67E-02	1.18E-02	5.85E-02
Eutrophication (kg N e)	8.99E-03	5.52E-03	1.45E-02
Ozone Depletion (kg CFC-11e)	1.75E-07	4.30E-07	6.05E-07
Smog Formation (kg O3e)	0.85	0.94	1.79
	Commercial Application – Technical Life		
GWP Inc Bio Carb (kg CO2e)	12.06	2.42	14.47
GWP Excl Bio Carb (kg CO2e)	12.07	2.46	14.53
Acidification (kg SO2e)	3.15E-02	8.08E-03	3.96E-02
Eutrophication (kg N e)	6.04E-03	3.71E-03	9.75E-03
Ozone Depletion (kg CFC-11e)	1.16E-07	2.87E-07	4.03E-07
Smog Formation (kg O3e)	0.58	0.63	1.21

	Industrial Application – Market/Technical Life		
GWP Inc Bio Carb (kg CO2e)	35.08	6.71	41.79
GWP Excl Bio Carb (kg CO2e)	35.12	6.83	41.96
Acidification (kg SO2e)	9.20E-02	2.30E-02	1.15E-01
Eutrophication (kg N e)	1.78E-02	1.10E-02	2.88E-02
Ozone Depletion (kg CFC-11e)	3.49E-07	8.60E-07	1.21E-06
Smog Formation (kg O3e)	1.19	0.36	1.55

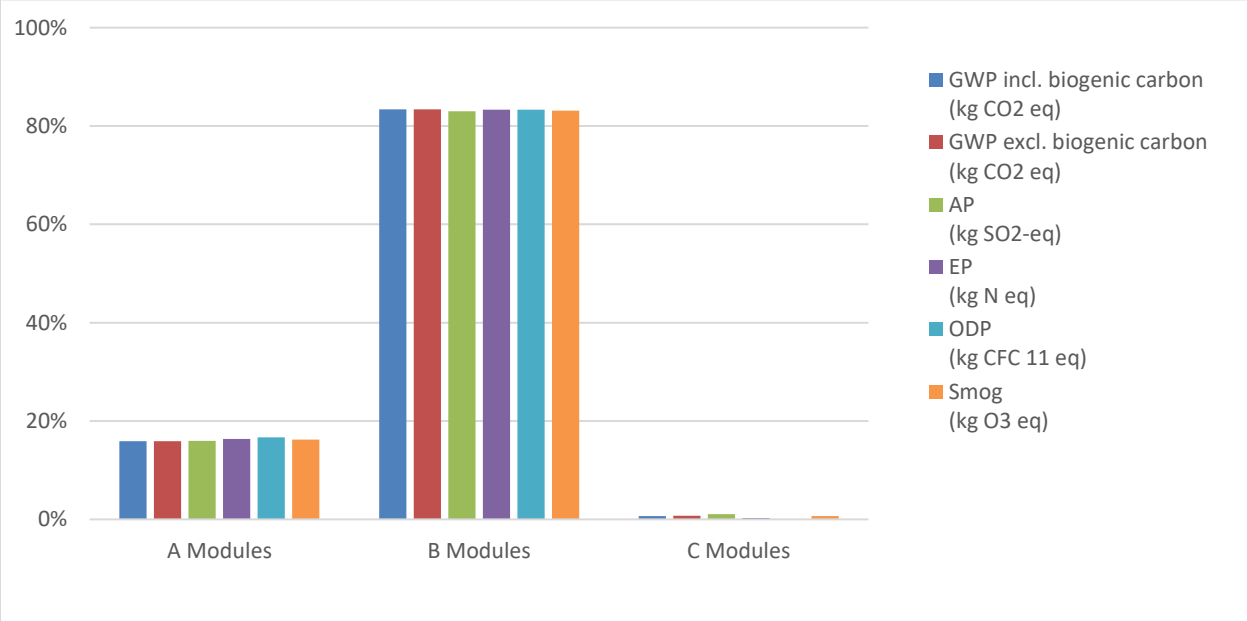

Figure 3. Floor Coating LCIA Impact Distribution by ISO 21930 Modules

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Resource Metrics:

Resource metrics are presented below in Table 12 and 13. Commercial and industrial applications are represented for the coating system as mixed. Specific resource metrics for an individual H&C™ 100% Solids Self-Levelling Epoxy formula are available upon request - Please contact sustainability@sherwin.com.

Table 11. 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 12. Resource Metrics for Commercial Application. H&C™ 100% Solids Self-Levelling Epoxy resinous flooring system as mixed (2 Parts A: 1 Part B).

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	53.34	1.21	1.46	1089.14	45.50	1.24E-05	1.01	0.00	0.00	1.59E-07	3.40E-06
		A2	2.31	1.42E-02	8.90E-02	6.97	2.13	2.75E-08	4.01E-04	0.00	0.00	4.69E-09	1.25E-07
		A3	0.75	7.78E-02	0.11	34.02	0.55	9.43E-09	2.68E-04	1.16E-03	0.00	7.55E-08	2.08E-06
	Construction Stage	A4	6.89	5.15E-02	0.33	23.61	6.37	8.3E-08	1.66E-03	0.00	0.00	6.35E-09	1.70E-07
		A5	0.93	0.28	5.89E-02	25.09	0.84	2.24E-08	1.19E-04	0.00	2.64E-03	4.13E-09	9.83E-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	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	321.10	8.16	10.25	5894.17	276.93	6.25E-05	5.06	5.81E-03	1.32E-02	1.25E-06	2.94E-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	0.64	3.92E-03	2.46E-02	1.94	0.59	7.59E-09	1.11E-04	0.00	0.00	1.29E-09	3.45E-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	1.90	0.64	0.14	50.69	1.72	4.29E-08	2.50E-04	0.00	1.58E-02	1.74E-08	4.58E-07
	Opt	D	-1.67	-0.50	0.15	74.29	-1.71	-3.67E-07	-8.21E-04	0.00	0.00	7.43E-11	1.78E-09
Technical	Product Stage	A1	53.34	1.21	1.46	1089.14	45.50	1.24E-05	1.01	0.00	0.00	1.59E-07	3.40E-06
		A2	2.31	1.42E-02	8.90E-02	6.97	2.13	2.75E-08	4.01E-04	0.00	0.00	4.69E-09	1.25E-07
		A3	0.75	7.78E-02	0.11	34.02	0.55	9.43E-09	2.68E-04	1.16E-03	0.00	7.55E-08	2.08E-06
	Construction Stage	A4	2.71	2.03E-02	0.13	9.30	2.51	3.27E-08	6.53E-04	0.00	0.00	6.35E-09	1.70E-07
		A5	0.37	0.11	2.32E-02	9.88	0.33	8.81E-09	4.69E-05	0.00	2.64E-03	4.13E-09	9.83E-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	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	178.44	4.29	5.45	3447.93	153.05	3.73E-05	3.04	3.49E-03	7.91E-03	7.48E-07	1.76E-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	0.42	2.61E-03	1.64E-02	1.30	0.39	5.06E-09	7.37E-05	0.00	0.00	8.60E-10	2.30E-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	1.27	0.43	9.49E-02	33.79	1.15	2.86E-08	1.66E-04	0.00	1.05E-02	1.16E-08	3.05E-07
	Opt	D	-1.11	-0.33	9.94E-02	49.53	-1.14	-2.4E-07	-5.47E-04	0.00	0.00	4.95E-11	1.19E-09

[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 13*:* Resource Metrics for Industrial Application. H&C™ 100% Solids Self-Levelling Epoxy resinous flooring system as mixed (2 Parts A: 1 Part B).

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	Product Stage	A1	53.34	1.21	1.46	1089.14	45.50	1.24E-05	1.01	0.00	0.00	1.59E-07	3.40E-06
		A2	2.31	1.42E-02	8.90E-02	6.97	2.13	2.75E-08	4.01E-04	0.00	0.00	4.69E-09	1.25E-07
		A3	0.75	7.78E-02	0.11	34.02	0.55	9.43E-09	2.68E-04	1.16E-03	0.00	7.55E-08	2.08E-06
	Construction Stage	A4	2.71	2.03E-02	0.13	9.30	2.51	3.27E-08	6.53E-04	0.00	0.00	6.35E-09	1.70E-07
		A5	0.37	0.11	2.32E-02	9.88	0.33	8.81E-09	4.69E-05	0.00	2.64E-03	4.13E-09	9.83E-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	6.54E+02	15.72	19.98	12642.41	561.20	1.37E-04	11.13	1.28E-02	2.90E-02	2.74E-06	6.47E-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	1.27	7.58E-03	4.76E-02	3.76	1.14	1.47E-08	2.14E-04	0.00	0.00	2.50E-09	6.68E-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	3.69	1.24	0.28	98.13	3.33	8.31E-08	4.83E-04	0.00	3.06E-02	3.36E-08	8.87E-07
	Opt	D	-3.23	-0.96	0.29	1.44E+02	-3.31	-7.11E-07	-1.59E-03	0.00	0.00	1.44E-10	3.44E-09

[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 solvents. 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, as well as, commercial vs industrial application scenarios. 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 thinkstep and ecoinvent databases are widely accepted by the LCA community and CEPE's LCI Database is based off 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 marginally 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.

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	50.18065A	48 g/L	Determined by EPA VOC Regulatory Calculation
Part B	50.18065B	334 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)	2.58	0.11	2.98E-02	0.13	1.48E-02	0.00	-	0.00	14.30	0.00	0.00	2.90E-02	0.00	7.52E-02	-0.12
GWP Excl Bio Carb (kg CO2e)	2.58	0.11	2.98E-02	0.13	1.51E-02	0.00	-	0.00	14.32	0.00	0.00	2.92E-02	0.00	7.88E-02	-0.12
Acidification (kg SO2e)	6.80E-03	2.97E-04	4.52E-05	2.85E-04	6.83E-05	0.00	-	0.00	3.75E-02	0.00	0.00	8.42E-05	0.00	3.48E-04	-2.11E-04
Eutrophication (kg N e)	1.39E-03	3.52E-05	3.43E-06	4.05E-05	3.71E-06	0.00	-	0.00	7.35E-03	0.00	0.00	9.93E-06	0.00	1.96E-05	-1.7E-05
Ozone Depletion (kg CFC-11e)	2.91E-08	1.13E-17	1.41E-16	1.51E-17	2.52E-15	0.00	-	0.00	1.46E-07	0.00	0.00	3.11E-18	0.00	2.58E-16	-2.9E-16
Smog Formation (kg O3e)	7.51E-02	9.45E-03	6.45E-04	8.95E-03	4.26E-02	0.00	-	0.00	0.68	0.00	0.00	1.89E-03	0.00	6.14E-03	-2.06E-03
Part B															
GWP Inc Bio Carb (kg CO2e)	0.41	4.56E-02	1.29E-02	5.46E-02	6.42E-03	0.00	-	0.00	2.65	0.00	0.00	1.26E-02	0.00	3.26E-02	-5.37E-02
GWP Excl Bio Carb (kg CO2e)	0.42	4.58E-02	1.29E-02	5.57E-02	6.55E-03	0.00	-	0.00	2.69	0.00	0.00	1.27E-02	0.00	3.42E-02	-5.36E-02
Acidification (kg SO2e)	1.53E-03	1.29E-04	1.96E-05	1.24E-04	2.96E-05	0.00	-	0.00	9.15E-03	0.00	0.00	3.65E-05	0.00	1.51E-04	-9.2E-05
Eutrophication (kg N e)	8.71E-04	1.53E-05	1.49E-06	1.76E-05	1.61E-06	0.00	-	0.00	4.53E-03	0.00	0.00	4.31E-06	0.00	8.52E-06	-7.3E-06
Ozone Depletion (kg CFC-11e)	7.17E-08	4.88E-18	6.22E-17	6.53E-18	1.09E-15	0.00	-	0.00	3.58E-07	0.00	0.00	1.35E-18	0.00	1.12E-16	-1.3E-16
Smog Formation (kg O3e)	1.99E-02	4.10E-03	2.80E-04	3.88E-03	0.13	0.00	-	0.00	0.77	0.00	0.00	8.20E-04	0.00	2.66E-03	-8.93E-04
Mixed (2:1)															
GWP Inc Bio Carb (kg CO2e)	2.99	0.15	4.27E-02	0.18	2.12E-02	0.00	0.82	0.00	16.95	0.00	0.00	4.16E-02	0.00	0.11	-0.18
GWP Excl Bio Carb (kg CO2e)	3.00	0.15	4.27E-02	0.18	2.16E-02	0.00	0.82	0.00	17.01	0.00	0.00	4.18E-02	0.00	0.11	-0.18
Acidification (kg SO2e)	8.32E-03	4.26E-04	6.48E-05	4.09E-04	9.79E-05	0.00	1.91E-03	0.00	4.66E-02	0.00	0.00	1.21E-04	0.00	4.99E-04	-3.03E-04
Eutrophication (kg N e)	2.26E-03	5.05E-05	4.92E-06	5.81E-05	5.32E-06	0.00	2.08E-04	0.00	1.19E-02	0.00	0.00	1.42E-05	0.00	2.82E-05	-2.42E-05
Ozone Depletion (kg CFC-11e)	1.01E-07	1.61E-17	2.06E-16	2.16E-17	3.62E-15	0.00	2.40E-15	0.00	5.04E-07	0.00	0.00	4.45E-18	0.00	3.70E-16	-4.16E-16
Smog Formation (kg O3e)	9.50E-02	1.35E-02	9.25E-04	1.28E-02	0.17	0.00	3.57E-02	0.00	1.45	0.00	0.00	2.71E-03	0.00	8.80E-03	-2.95E-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.
- Opt = Optional supplementary info beyond the system boundary

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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)	2.58	0.11	2.98E-02	0.13	1.48E-02	0.00	-	0.00	8.58	0.00	0.00	1.93E-02	0.00	5.01E-02	-8.26E-02
GWP Excl Bio Carb (kg CO2e)	2.58	0.11	2.98E-02	0.13	1.51E-02	0.00	-	0.00	8.59	0.00	0.00	1.95E-02	0.00	5.25E-02	-8.24E-02
Acidification (kg SO2e)	6.80E-03	2.97E-04	4.52E-05	2.85E-04	6.83E-05	0.00	-	0.00	2.25E-02	0.00	0.00	5.61E-05	0.00	2.32E-04	-1.41E-04
Eutrophication (kg N e)	1.39E-03	3.52E-05	3.43E-06	4.05E-05	3.71E-06	0.00	-	0.00	4.41E-03	0.00	0.00	6.62E-06	0.00	1.31E-05	-1.13E-05
Ozone Depletion (kg CFC-11e)	2.91E-08	1.13E-17	1.41E-16	1.51E-17	2.52E-15	0.00	-	0.00	8.74E-08	0.00	0.00	2.07E-18	0.00	1.72E-16	-1.93E-16
Smog Formation (kg O3e)	7.51E-02	9.45E-03	6.45E-04	8.95E-03	4.26E-02	0.00	-	0.00	0.41	0.00	0.00	1.26E-03	0.00	4.09E-03	-1.37E-03
Part B															
GWP Inc Bio Carb (kg CO2e)	0.41	4.56E-02	1.29E-02	5.46E-02	6.42E-03	0.00	-	0.00	1.59	0.00	0.00	8.38E-03	0.00	2.17E-02	-3.58E-02
GWP Excl Bio Carb (kg CO2e)	0.42	4.58E-02	1.29E-02	5.57E-02	6.55E-03	0.00	-	0.00	1.62	0.00	0.00	8.44E-03	0.00	2.28E-02	-3.58E-02
Acidification (kg SO2e)	1.53E-03	1.29E-04	1.96E-05	1.24E-04	2.96E-05	0.00	-	0.00	5.49E-03	0.00	0.00	2.43E-05	0.00	1.01E-04	-6.11E-05
Eutrophication (kg N e)	8.71E-04	1.53E-05	1.49E-06	1.76E-05	1.61E-06	0.00	-	0.00	2.72E-03	0.00	0.00	2.87E-06	0.00	5.68E-06	-4.89E-06
Ozone Depletion (kg CFC-11e)	7.17E-08	4.88E-18	6.22E-17	6.53E-18	1.09E-15	0.00	-	0.00	2.15E-07	0.00	0.00	8.98E-19	0.00	7.47E-17	-8.38E-17
Smog Formation (kg O3e)	1.99E-02	4.10E-03	2.80E-04	3.88E-03	0.13	0.00	-	0.00	0.46	0.00	0.00	5.46E-04	0.00	1.77E-03	-5.95E-04
Mixed (2:1)															
GWP Inc Bio Carb (kg CO2e)	2.99	0.15	4.27E-02	0.18	2.12E-02	0.00	0.82	0.00	10.17	0.00	0.00	2.77E-02	0.00	7.19E-02	-0.12
GWP Excl Bio Carb (kg CO2e)	3.00	0.15	4.27E-02	0.18	2.16E-02	0.00	0.82	0.00	10.21	0.00	0.00	2.79E-02	0.00	7.53E-02	-0.12
Acidification (kg SO2e)	8.32E-03	4.26E-04	6.48E-05	4.09E-04	9.79E-05	0.00	1.91E-03	0.00	2.80E-02	0.00	0.00	8.05E-05	0.00	3.33E-04	-2.02E-04
Eutrophication (kg N e)	2.26E-03	5.05E-05	4.92E-06	5.81E-05	5.32E-06	0.00	2.08E-04	0.00	7.13E-03	0.00	0.00	9.49E-06	0.00	1.88E-05	-1.62E-05
Ozone Depletion (kg CFC-11e)	1.01E-07	1.61E-17	2.06E-16	2.16E-17	3.62E-15	0.00	2.40E-15	0.00	3.02E-07	0.00	0.00	2.97E-18	0.00	2.47E-16	-2.77E-16
Smog Formation (kg O3e)	9.50E-02	1.35E-02	9.25E-04	1.28E-02	0.17	0.00	3.57E-02	0.00	0.87	0.00	0.00	1.81E-03	0.00	5.86E-03	-1.97E-03

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- Opt = Optional supplementary info beyond the system boundary

SHERWIN-WILLIAMS.

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

Industrial Application – Market/Technical Life															
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)	2.58	0.11	2.98E-02	0.13	1.48E-02	0.00	-	0.00	31.46	0.00	0.00	5.80E-02	0.00	0.15	-0.25
GWP Excl Bio Carb (kg CO2e)	2.58	0.11	2.98E-02	0.13	1.51E-02	0.00	-	0.00	31.50	0.00	0.00	5.84E-02	0.00	0.16	-0.25
Acidification (kg SO2e)	6.80E-03	2.97E-04	4.52E-05	2.85E-04	6.83E-05	0.00	-	0.00	8.24E-02	0.00	0.00	1.68E-04	0.00	6.96E-04	-4.23E-04
Eutrophication (kg N e)	1.39E-03	3.52E-05	3.43E-06	4.05E-05	3.71E-06	0.00	-	0.00	1.62E-02	0.00	0.00	1.99E-05	0.00	3.93E-05	-3.38E-05
Ozone Depletion (kg CFC-11e)	2.91E-08	1.13E-17	1.41E-16	1.51E-17	2.52E-15	0.00	-	0.00	3.20E-07	0.00	0.00	6.21E-18	0.00	5.16E-16	-5.80E-16
Smog Formation (kg O3e)	7.51E-02	9.45E-03	6.45E-04	8.95E-03	4.26E-02	0.00	-	0.00	1.05	0.00	0.00	3.78E-03	0.00	1.23E-02	-4.12E-03
Part B															
GWP Inc Bio Carb (kg CO2e)	0.41	4.56E-02	1.29E-02	5.46E-02	6.42E-03	0.00	-	0.00	5.82	0.00	0.00	2.52E-02	0.00	6.52E-02	-0.11
GWP Excl Bio Carb (kg CO2e)	0.42	4.58E-02	1.29E-02	5.57E-02	6.55E-03	0.00	-	0.00	5.93	0.00	0.00	2.53E-02	0.00	6.83E-02	-0.11
Acidification (kg SO2e)	1.53E-03	1.29E-04	1.96E-05	1.24E-04	2.96E-05	0.00	-	0.00	2.01E-02	0.00	0.00	7.30E-05	0.00	3.02E-04	-1.83E-04
Eutrophication (kg N e)	8.71E-04	1.53E-05	1.49E-06	1.76E-05	1.61E-06	0.00	-	0.00	9.98E-03	0.00	0.00	8.62E-06	0.00	1.70E-05	-1.47E-05
Ozone Depletion (kg CFC-11e)	7.17E-08	4.88E-18	6.22E-17	6.53E-18	1.09E-15	0.00	-	0.00	7.88E-07	0.00	0.00	2.69E-18	0.00	2.24E-16	-2.52E-16
Smog Formation (kg O3e)	1.99E-02	4.10E-03	2.80E-04	3.88E-03	0.13	0.00	-	0.00	0.32	0.00	0.00	1.64E-03	0.00	5.32E-03	-1.79E-03
Mixed (2:1)															
GWP Inc Bio Carb (kg CO2e)	2.99	0.15	4.27E-02	0.18	2.12E-02	0.00	0.82	0.00	37.29	0.00	0.00	8.31E-02	0.00	0.22	-0.36
GWP Excl Bio Carb (kg CO2e)	3.00	0.15	4.27E-02	0.18	2.16E-02	0.00	0.82	0.00	37.43	0.00	0.00	8.37E-02	0.00	0.23	-0.35
Acidification (kg SO2e)	8.32E-03	4.26E-04	6.48E-05	4.09E-04	9.79E-05	0.00	1.91E-03	0.00	1.03E-01	0.00	0.00	2.41E-04	0.00	9.98E-04	-6.06E-04
Eutrophication (kg N e)	2.26E-03	5.05E-05	4.92E-06	5.81E-05	5.32E-06	0.00	2.08E-04	0.00	2.61E-02	0.00	0.00	2.85E-05	0.00	5.63E-05	-4.85E-05
Ozone Depletion (kg CFC-11e)	1.01E-07	1.61E-17	2.06E-16	2.16E-17	3.62E-15	0.00	2.40E-15	0.00	1.11E-06	0.00	0.00	8.90E-18	0.00	7.40E-16	-8.31E-16
Smog Formation (kg O3e)	9.50E-02	1.35E-02	9.25E-04	1.28E-02	0.17	0.00	3.57E-02	0.00	1.37	0.00	0.00	5.42E-03	0.00	1.76E-02	-5.90E-03

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