

Environmental Product Declaration – H&C® HYDRO-DEFEND® Water- Based¹



**Certified
Environmental
Product Declaration**
www.nsf.org

H&C® HYDRO-DEFEND® Water-Based Concrete & Driveway Protector is a clear siloxane water repellent that is designed to protect exterior bare concrete driveways and masonry surfaces.



For additional information, please visit www.hcconcrete.com

The product image to the right is an example of the formula covered by the EPD. A list of all relevant H&C® HYDRO-DEFEND® Water-Based formulas are shown in Table 1 on page 2 of the EPD.

Declaration Holder	The Sherwin-Williams Company (sustainability@sherwin.com)
Declaration Number	EPD10868
Declared Product	H&C® HYDRO-DEFEND® Water-Based
Product Category and Subcategory	Architectural Coatings – Concrete Coatings
Program Operator	NSF Certification LLC ncss@nsf.org
Reference PCR	PCR for Architectural Coatings
Link to available EPDs	https://www.nsf.org/certified-products-systems

Date of Issue	August 30, 2023
Period of Validity	5 Years

Contents of the Declaration	<ul style="list-style-type: none"> – Product definition and material characteristics – Overview of manufacturing process – Information about in-use conditions – Life cycle assessment results – Testing verifications
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The PCR review was conducted by	Thomas P. Gloria, Ph. D. Industrial Ecology Consultants t.gloria@industrial-ecology.com
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This EPD was independently verified by NSF Certification LLC in accordance with ISO 21930 and ISO 14025. <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	Jack Geibig – EcoForm jgeibig@ecoform.com	
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by	Jack Geibig – EcoForm jgeibig@ecoform.com	

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
LCA Software Used	GaBi (10.0.0.71)
Market-Based Lifetime Used in Assessment	5 years
Design Lifetime Used in Assessment	10 years
Test Methods Used to Calculate Design Life	See <i>Test Methods</i> list on page 6
Estimated Amount of Colorant	Varies (see Table 4)
Data Quality Assessment Score	Very Good
Manufacturing Location(s)	Various Plants Throughout the United States

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, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 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.

Product Definition:

H&C® HYDRO-DEFEND® Water-Based is an interior/exterior concrete architectural coating manufactured by The Sherwin-Williams Company, headquartered in Cleveland, Ohio. H&C® HYDRO-DEFEND® Water-Based 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® HYDRO-DEFEND® Water-Based was produced. This coating is designed to cover and protect architectural surfaces such as concrete and masonry. For information about specific products, please visit www.hcconcrete.com.

Product Classification and Description:

The H&C® HYDRO-DEFEND® Water-Based product listed below are included within this assessment. For information on other attributes of each of the specific formulations, please visit www.hcconcrete.com.

Table 1. List of H&C® HYDRO-DEFEND® Water-Based Formulas Assessed by LCA Model and Report.

<u>Product ID for EPD</u>	<u>Product Numbers Included</u>		<u>Base Type as Defined by PCR</u>
50.154154	50.154154-16	1 Gallon	Clear/Other
	50.154155-20	5 Gallon	

Under the Product Category Rule (PCR) for Architectural Coatings, H&C® HYDRO-DEFEND® Water-Based falls under the following heading: ²

- Concrete curing, sealing, & protective coatings: “A clear or opaque coating that is formulated primarily for application to concrete and masonry surfaces.”

Concrete 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. Any unused coating will be disposed 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 composition of the H&C® HYDRO-DEFEND® Water-Based coating is shown by % weight below.

- Water (40%-55%)
- Resin (20%-30%)
- Extender Pigments (10%-15%)
- Titanium Dioxide (0%-15%)
- Additives (1%-5%)

² American Coating Association Product Category Rule for Architectural Coatings. Available at http://standards.nsf.org/apps/group_public/download.php/28098/ACA%20PCR%20%2006-17-15%20-%20Final.pdf. Valid through June 30, 2024.

Table 2. List of Hazardous ingredients in the H&C® HYDRO-DEFEND® Water-Based formulas.

Ingredient	Percentage	CAS #
triethoxy(2,4,4-trimethylpentyl)silane	≤10	35435-21-3

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. The ranges reflect that many 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® HYDRO-DEFEND® Water-Based formula available on www.hconcrete.com.

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® HYDRO-DEFEND® Water-Based 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® HYDRO-DEFEND® Water-Based at your nearest Sherwin-Williams store or to have a sales representative contact you, call 800-524-5979.

Definitions:

Acronyms & Abbreviated Terms:

- **ACA:** American Coating Association
- **ASTM:** 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 an architectural coating 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 PE INTERNATIONAL GaBi Databases are LCA databases that contain ready-to-use Life Cycle Inventory profiles.
- **LCA:** Life Cycle Assessment or Analysis. 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).
- **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.
- **QUV:** Exterior coatings test for durability. Can be tested naturally, or by accelerated test chambers (Xenon Arc and QUV). The test chambers use artificial light – carbon or xenon arc sources in Weatherometers, and fluorescent UV in QUV chambers. The QUV chamber theoretically reproduces the damaging effects of sunlight using UVA-340 lamps, controlling elevated temperatures, and also introducing moisture much like dew.
- **TRACI:** Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts.

Terminology:

- **Architectural coating:** A coating recommended for field application to stationary structures or their appurtenances at the site of installation, to portable buildings, to pavements, or to curbs. For purposes of this PCR an 'architectural coating' does not include adhesives and coatings for shop applications or original equipment manufacturing, nor does it include coatings solely for application to non-stationary structures, such as airplanes, ships, boats, and railcars. *Please see the product category requirements in Section 1.1 of the PCR.*
- **Biologic growth or bio deterioration:** Any undesirable change in material properties brought about by the activities of microorganisms.
- **Blistering:** The formation of dome shaped hollow projections in paints or varnish films resulting from the local loss of adhesion and lifting of the film from the surface or coating.

- **Burnish resistance:** The resistance of a coating to an increase in gloss or sheen due to polishing or rubbing.
- **Color Fade/Chalking:** Color fade can be defined as the noticeable change in color of a coating due to weathering and the photochemical degradation of the coating by UV light. Chalking can be defined as the powdery residue of a degraded coating film, due to the photochemical degradation of the coating by UV light.
- **Design life:** The estimated lifetime of a coating based solely on its hiding and performance characteristics determined by results in certain ASTM durability tests.
- **Durability:** The degree to which coatings can withstand the destructive effect of the conditions to which they are subjected and how long they retain an acceptable appearance and continue to protect the substrate.
- **Erosion:** The wearing away of the top coating of a painted surface e.g., by chalking, or by the abrasive action of windborne particles of grit, which may result in exposure of the underlying surface. The degree of resistance is dependent on the amount of coating retained.
- **Flaking/Peeling:** The phenomenon manifested in paint films by the actual detachment of pieces of the film itself either from its substrate or from paint previously applied. Peeling can be considered as an aggravated form of flaking. It is frequently due to the collection of moisture beneath the film.
- **Gloss:** A value of specular reflection which is often used to categorize certain types of paints.
- **Intermediate processing:** the conversion of raw materials to intermediates (e.g. titanium dioxide ore into titanium dioxide pigment, etc.).
- **Market-based life:** The estimated lifetime of a coating based off the actual use pattern of the product type. In this instance, a repaint may occur before the coating fails.
- **Pigment:** The material(s) that give a coating its color.
- **Primary materials:** Resources extracted from nature. Examples include titanium dioxide ore, crude oil, etc. that are used to create basic materials used in the production of architectural coatings (e.g., titanium dioxide).
- **Resin/Binder:** Acts as the glue or adhesive to adhere the coating to the substrate.
- **Scrubbability or scrub resistance:** The ability of a coating to resist being worn away or to maintain its original appearance when rubbed repetitively with an abrasive material.
- **Secondary materials:** Recovered, reclaimed, or recycled content that is used to create basic materials to be used in the production of architectural coatings.
- **Washability:** The ease with which the dirt can be removed from a paint surface by washing; also refers to the ability of the coating to withstand washing without removal or substantial damage.

Underlying Life Cycle Assessment Methodology:

Functional Unit:

Per the reference PCR, the functional unit for the study was covering and protecting 1m² of substrate for a period of 60 years (the assumed lifetime of a building). Solid coatings shall exhibit 97% opacity after drying, whereas transparent and semitransparent coatings need not measure opacity. The product has no additional functionalities beyond what is stated by the functional unit.

In the reference PCR, product lifetimes for architectural concrete coatings were calculated both in terms of a typical market life and a design/technical life. In order to determine the design/technical life of architectural concrete formulas, durability test methodologies were utilized.

Relevant lifetimes are listed in the PCR and below in Table 3.

Table 3. Market and Design/Technical Lifetimes

	Market Lifetime	Design/Technical Lifetime
Concrete Coating		
Low Quality	5 years	5 years
Mid Quality		10 years
High Quality		20 years

In order to determine the design/technical life of architectural concrete formulas intended for concrete and masonry substrates, the following durability test methodologies are utilized:

Test Methods

- ASTM D2805-11 – Opacity (if relevant)
- ASTM D2486-06(2012)e1 – Scrub Resistance
- QUV Flaking/Peeling Adhesion
- ASTM D3274-95 – Biologic Growth
- QUV Color Fade/Chalking

A coverage rate of 200 sq ft/gallon was used in this report. More information on this product's application and coverage can be found in the products PDS. For PDS, please visit www.hcconcrete.com

Based on the durability test results, the appropriate quality levels and coating quantities were derived for each formula used to test the tool. If testing results were unavailable for a formula, then it was assumed to be of 'low' quality as dictated in the reference PCR. If the coating is a primer only the market-based lifetime is used. This is also consistent with the reference PCR. This same methodology will be applied to any coating that uses this EPD tool and its performance results shall be disclosed in a similar manner.

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

Formula	Application	Quality Level	Market Lifetime	Technical Lifetime	Market Lifetime Quantity Needed (kg)	Technical Lifetime Quantity Needed (kg)	Market Lifetime Tint Needed (g)	Technical Lifetime Tint Needed (g)
50.154154	Concrete	Mid	5 years	10 years	2.40	1.20	NA	NA

Tinting:

As stated in the reference PCR, the tint/colorant inventory was taken from thinkstep carbon black pigment data in the appropriate quantity specified by the type of coating base of the formula. The amount of colorant needed for each formula is shown in Table 4 above. This coating is clear so tint information was not applicable to this product.

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:

In accordance with the reference PCR, global warming values were calculated and presented both including and excluding biogenic carbon.

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® HYDRO-DEFEND® Water-Based 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.

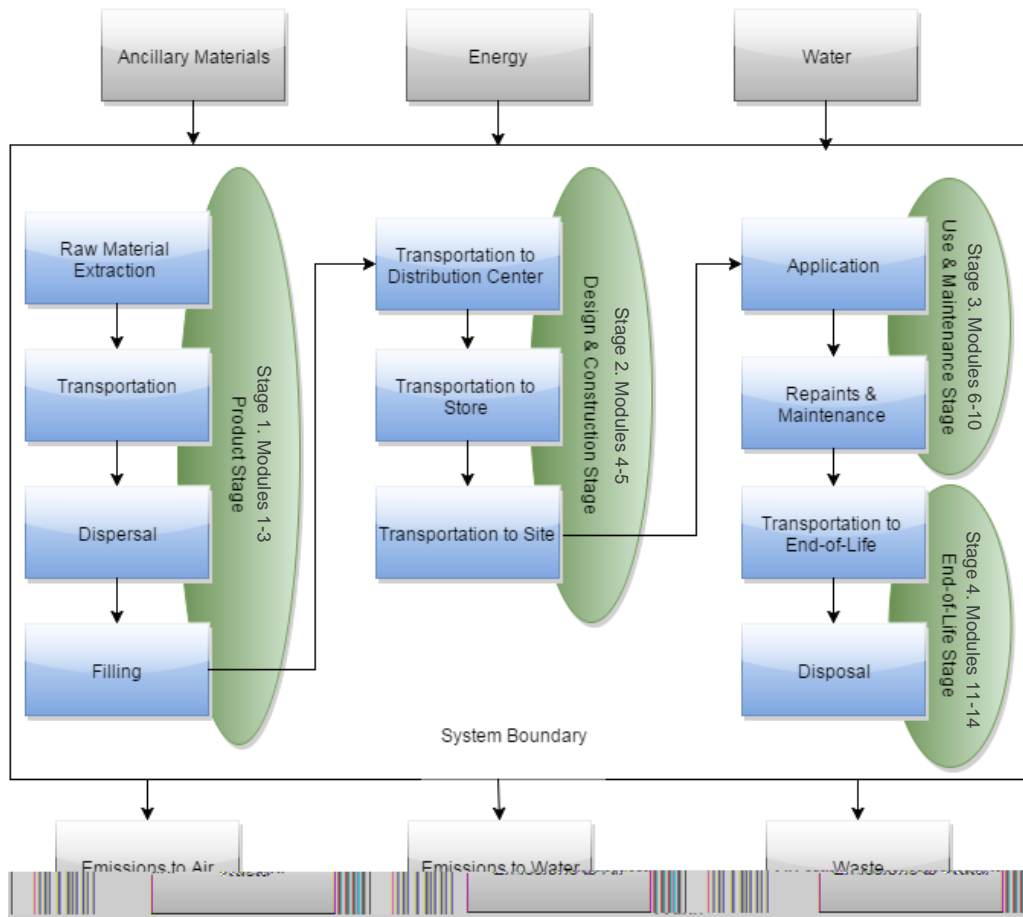


Figure 1. Diagram of System Boundary for the EPD.

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. All formulas were modeled to at least 99.9% of their material content by weight. No significant flows were excluded from the LCA models and the 5% threshold prescribed by the PCR was not exceeded.

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 5. 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.
Sphera/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. Last updated in 2020. Made up of refined data from thinkstep and ecoinvent so that it is more representative of coating 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 GaBi and ecoinvent databases and CEPE's 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 data was taken from ecoinvent and resin data was taken from primary sources and 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.

Reproducibility is possible using 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-to-date versions of the LCA databases mentioned above.





Geographic Coverage:

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


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 6. Overview of Impact Categories³

Overview of LCA Impact Categories	
Impact Category Name	Description of Impact Category
<p>Global Warming Potential</p> 	<p><i>“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).</i></p> <p><i>Biogenic carbon was both included and excluded in the analysis as stipulated by the PCR.</i></p>
<p>Ozone Depletion Potential</p> 	<p><i>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).</i></p>
<p>Acidification Potential</p> 	<p><i>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).</i></p>
<p>Smog Formation Potential</p> 	<p><i>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).</i></p>

³ See EPA TRACI References for Additional Details

<p>Eutrophication Potential</p> 	<p><i>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).</i></p>
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Life Cycle Impact Assessment Results:

The LCA results are documented and grouped separately below into the following stages as defined by the PCR.

- Total Impact (across the entire cradle-to-grave lifecycle including tinting)
- Product Stage (Stage 1)
- Construction & Design Stage (Stage 2)
- Use & Maintenance Stage (Stage 3)
- End-Of-Life Stage (Stage 4)

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. LCIA results for each life cycle stage as defined by the PCR are shown graphically in Figure 2.

Table 7. LCA Results for Market Life Scenario.

	GWP Inc Bio Carb (kg CO2e)	GWP Exc Bio Carb (kg CO2e)	Acidification (kg SO2e)	Eutrophication (kg N e)	Ozone Depletion (kg CFC - 11e)	Smog Formation (kg O3e)
50.154154	2.73	2.76	8.88E-03	3.77E-03	1.83E-07	0.14

Table 8. LCA Results for Technical/Design Life Scenario.

	GWP Inc Bio Carb (kg CO2e)	GWP Exc Bio Carb (kg CO2e)	Acidification (kg SO2e)	Eutrophication (kg N e)	Ozone Depletion (kg CFC - 11e)	Smog Formation (kg O3e)
50.154154	1.36	1.38	4.44E-03	1.89E-03	9.16E-08	6.93E-02

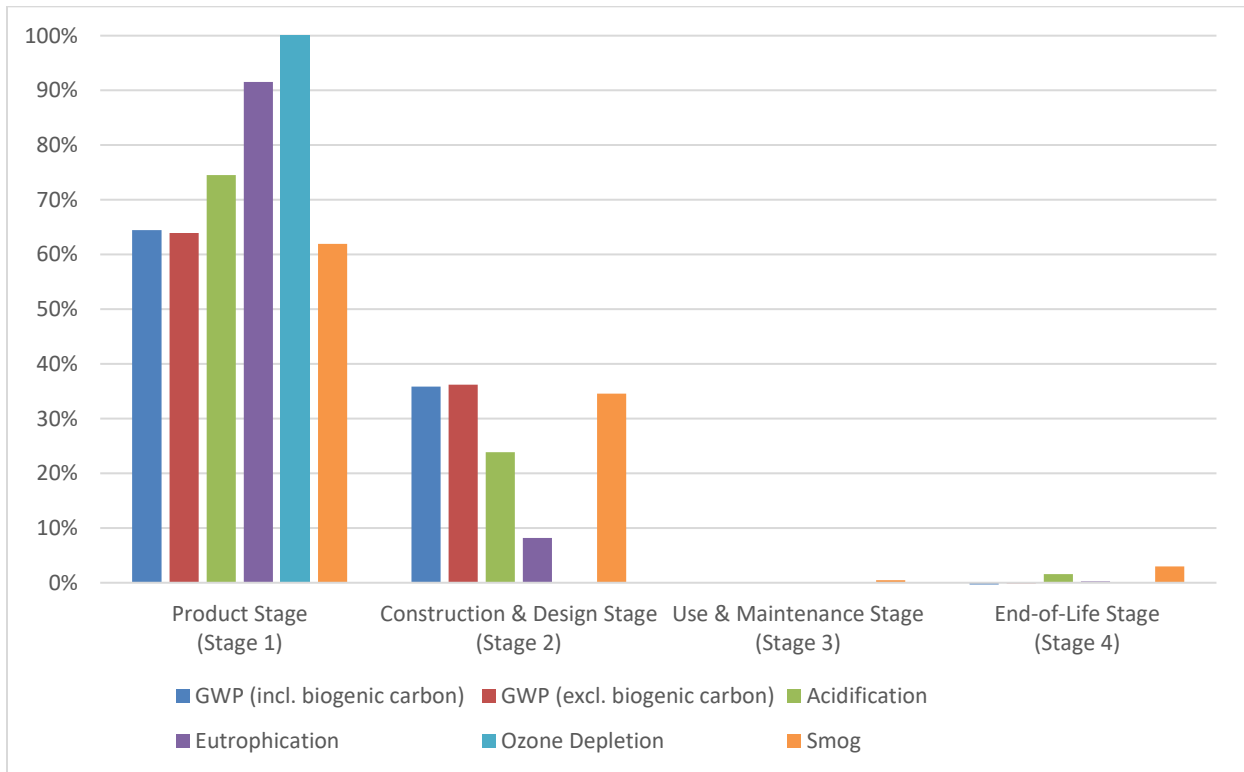


Figure 2. Impact Category Result Breakdown by PCR Life Cycle Stage for the H&C® HYDRO-DEFEND® Water-Based Formulation.

Table 9. Energy, Resource, and Waste Results.

		Market Life					Technical Life				
		Stage 1	Stage 2	Stage 3	Stage 4	TOTAL	Stage 1	Stage 2	Stage 3	Stage 4	TOTAL
CONCRETE	Use of Non-Renew. Energy (MJ)	32.37	14.70	6.98E-04	0.32	47.39	16.18	7.35	3.49E-04	0.16	23.70
	Use of Renewable Primary Energy (MJ)	2.71	0.70	6.88E-05	0.18	3.59	1.35	0.35	3.44E-05	8.85E-02	1.80
	Use of Non-Renew Mat. Resources (kg)	1.88	0.11	2.17E-04	0.17	2.16	0.94	5.53E-02	1.09E-04	8.57E-02	1.08
	Use of Renewable Mat. Resources (kg)	9926.32	50.35	0.27	64.26	10041.20	4963.16	25.18	0.14	32.13	5020.60
	Consumption of Freshwater (m3)	0.13	3.55E-03	2.40E-04	-1.93E-05	0.14	6.70E-02	1.77E-03	1.20E-04	-9.65E-06	6.89E-02
	Hydro Power (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Fossil Energy (MJ)	29.49	14.63	6.50E-04	0.27	44.38	14.75	7.31	3.25E-04	0.13	22.19
	Bio-energy (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Nuclear Energy (MJ)	2.88	7.26E-02	4.72E-05	5.83E-02	3.01	1.44	3.63E-02	2.36E-05	2.91E-02	1.50
	Other Energy (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Secondary Fuels (MJ)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Recycled Materials (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Secondary Raw Materials (kg)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Non-Hazardous Waste	N/A	N/A	N/A	N/A	79.50%	N/A	N/A	N/A	N/A	79.50%
	Hazardous Waste	N/A	N/A	N/A	N/A	20.50%	N/A	N/A	N/A	N/A	20.50%

Interpretation:

For the H&C® HYDRO-DEFEND® Water-Based formulation, the raw materials were responsible for the largest environmental impact across all impact categories. Specifically, the resins were the most impactful raw materials. Manufacturing, packaging, use, and disposal were only responsible for a small percent of overall impact. Transportation impacts were significant for several impact categories, but still much smaller than those of the raw materials.

Since the raw materials were responsible for the largest chunk of the impact, product performance and durability were especially important. 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 many 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 and ecoinvent databases are widely accepted by the LCA community and CEPE's LCI Database is based off Sphera and ecoinvent data, just 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 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.

As stated in the LCA report, 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 very small amount of the overall formula (less than a percent), but still may impact the results. Likewise, there were cases where data had to be used from a

different region or technology. These instances were uncommon and noted in the Data Quality section of the report 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 environmental data sheets for the specific H&C® HYDRO-DEFEND® Water-Based 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 commissioned Mr. Jack Geibig of EcoForm to conduct the formal review of the LCA report.



Additional Environmental Information:

VOC Content	
<50 g/L	Determined by EPA VOC Regulatory Calculation

Preferred End-of Life Options:

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. Additional information can also be found on the Sherwin-Williams website at: <https://www.sherwin-williams.com/en-us/project-center/paint/how-to-recycle-dispose-paint>.

References:

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