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Environmental Product Declaration – POWDURA® ECO

Sherwin-Williams POWDURA® ECO Powder Coatings turn plastic waste into sustainable powder coatings. Each pound of powder coatings contains the recycled plastic content equivalent to sixteen - 16 oz—water bottles. Available currently in TGIC and TGIC-free polyester formulations with both in-stock and make-to-order products available, Powdura Eco powder coatings put waste to work.

The product image to the right is an example of one of the formulas covered by the EPD. A list of all relevant POWDURA® ECO formulas is shown in Table 1 on page 2 of the EPD.



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



Program Operator	NSF Certification, LLC
Declaration Holder	The Sherwin-Williams Company 101 W. Prospect Ave., Cleveland, OH, 44115
Declaration Prepared by	Sherwin Williams Global Sustainability
Declaration Number	EPD11152
Product Category and Subcategory	Powder Coatings
Reference PCR	NSF PCR for Powder Coatings – 6/2020

Date of Issue	Nov 07 2025
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 – Testing verifications
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The PCR review was conducted by	Thomas P. Gloria, Ph. D. t.gloria@industrial-ecology.com
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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 
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by	Jack Geibig - EcoForm jgeibig@ecoform.com 

Declared Unit:	1 kg of product
System Boundary	Cradle-to-Gate (A1-A3 only)
Data Quality Assessment Score	Very Good
Manufacturing Location(s)	Various Plants Throughout The United States
Software Program Used	LCAFE (most recent version available at time of report)

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 including use of the same sub-category PCR, the same relevant information modules, and are based on the same equivalent scenarios. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis. In addition, only EPDs using a functional unit are eligible for comparison. Since this EPD uses a declared unit, comparisons with other EPDs are not possible.



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

Product Definition:

POWDURA® ECO is a family of powder coatings manufactured by The Sherwin-Williams Company, headquartered at 101 West Prospect Ave. in Cleveland, Ohio. POWDURA® ECO 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 POWDURA® ECO was produced. These Sherwin-Williams powder coatings are 100% solids coatings designed to cover and protect a variety of architectural surfaces such as shelving, wall panels, etc. and are applied off-site by the end-user. For information about specific products, please visit www.sherwin.com.

Product Classification and Description:

POWDURA® ECO products listed below are included within this assessment. For information on other attributes of each of the specific formulations, please visit www.sherwin.com.

Table 1. List of POWDURA® ECO Formulas Assessed by LCA Model and Report.

<u>Product Name</u>	<u>Color</u>	<u>Product Code</u>
POWDURA® ECO	ECO LOW GLOSS BLACK	PBS4-80R00
POWDURA® ECO	ECO GLOSS BLACK	PBS9-80R00
POWDURA® ECO	ECO BLACK SAND TEX	PBT2-80R09
POWDURA® ECO	ECO ARCHITECTURAL BRONZE	PDS4-80R00
POWDURA® ECO	ECO SILVER	PSZ4-80R00
POWDURA® ECO	BRITE WHITE ECO	PWS4-V0R00
POWDURA® ECO	ECO GLOSS WHITE	PWS8-80R15
POWDURA® ECO	BRITE WHITE TEXTURE ECO	PWT2-V0R00

Powder Coatings are manufactured in a way somewhat similar to other paint and coating products, with some intermediate steps unique to powders. Raw materials are manually added in appropriate quantities into a high-speed disperser to create a consistent pre-mixed blend. This raw material blend is



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then moved to an extruder, which heats the resin and evenly distributes the additives and pigments within the resin blend, creating the coating. When the hot blend leaves the extruder, it proceeds onto chilled rollers which cool material, and it is subsequently mechanically broken into flakes via a grind and sieve process. The product is then moved via compressed air or gravity and filled into containers and transported to the distribution center and to the customer. Powder coatings are applied in a facility by



the customer as opposed to on a construction site. 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.

The typical composition of a Powder Coating is shown below.

Resin (50%-80%)
Extender Pigments (10%-50%)
Titanium Dioxide (0-15%)
Additives (5%-20%)

Aside from the ingredients present in the table below, 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. For additional information about product hazards, please refer to the Safety Data Sheet for the specific POWDURA® ECO formula available on www.sherwin.com.

Table 2. List of Hazardous ingredients in the POWDURA® ECO formulas assessed.

Ingredient	Percentage	CAS #	Reference Standard
Titanium Dioxide	0 - ≤25	13463-67-7	GHS
Barium Sulfate	0 - ≤25	7727-43-7	GHS
Calcium Carbonate	10 - ≤50	1317-65-3	GHS
Aluminum Hydroxide	0 - ≤25	21645-51-2	GHS
Triglycidyl Isocyanurate	≤6.9	2451-62-9	GHS
Aluminum	≤3	7429-90-5	GHS
Paraffin Wax	≤3	8002-74-2	GHS
Amorphous Silica	≤3	7631-86-9	GHS
Iron Oxide	≤3	1309-37-1	GHS
Crystalline Silica	≤0.3	14808-60-7	GHS

About Sherwin-Williams:

For 150 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. POWDURA® ECO is just one more way we bring you industry-leading paint technology — innovation you can pass on to your customers. Plus, with more than 4,000 stores and 2,400 sales representatives across North America, personal service and expert advice is always available near jobsites. Find out more about POWDURA® ECO 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. 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 Sphera, 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.

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, and construction.
- **Generic data:** Defined by the ILCD Handbook² as “a generic data set has been developed using at least partly other information than 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 surfacing material which would require substantial or complete removal in order to return the substrate to serviceable condition.

² The United Statesan Commission, The United Statesan Platform on Life Cycle Assessment, International Life Cycle Data system, available at: <https://eplca.jrc.ec.europa.eu/ilcd.html>



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- **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 or 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.).
 - **Pigment:** The material(s) that give a coating its color.
 - **Powder Coating:** a 100% solids coating applied as a dry powder which, when baked at a sufficient temperature, melts out to form a continuous film.
 - **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:

Declared Unit:

Per the reference PCR, the declared unit for the study was 1 kg of 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.

System Boundary:

This LCA included all relevant steps in the coating manufacturing process as described by the reference PCR. Raw materials are manually added in appropriate quantities into a high-speed disperser to create a consistent pre-mixed blend. This raw material blend is then moved to an extruder, which heats the resin and evenly distributes the additives and pigments within the resin blend, creating the coating. When the hot blend leaves the extruder, it proceeds onto chilled rollers which cool material, and it is subsequently mechanically broken into flakes via a grind and sieve process. The product is then moved via compressed air or gravity and filled into containers and transported to the distribution center and to the customer. Powder coatings are applied in a facility by the customer as opposed to on a construction site. 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. The system boundary ends with the final powder coating product at the production gate before it is distributed to the end-user's facility. This can be seen in Figure 1, below.

All impacts were assessed using a 100-year time horizon as required by ISO 21930:2017.

All significant resource extraction, raw material transportation, and manufacturing for the creation of Powder Coatings were included. All relevant processes were accounted in the LCA models.

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); and

- all point of sale infrastructure;

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE	USE STAGE								END OF LIFE STAGE			
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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4

Figure 1. Diagram of System Boundary Covered by LCA Models and Report. Modified from ISO 21930:2017. Module A1-A3, the Product Stage, were included in this study. All other modules were omitted.

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. 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. Any gaps that did occur in assessing material content were due to materials being a trade secret or LCI data (and suitable proxies) being unavailable.



Data Sources & Quality:

When primary data was unavailable, data was taken from either Sphera, Ecoinvent, or CEPE's coating industry life cycle inventory. The data from Sphera 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 3. 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 2019 relevant facilities operation metrics.
Sphera/GaBi	DB Version 10.9.0.31
ecoinvent	Version 3.3 – Most recent version available in GaBi.
CEPE LCI	Most recent version of industry LCI. Last revised in 2016. Made up of refined data from Sphera 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 2019 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 2016 coating life cycle inventory. These databases were assessed in terms of overall completeness.

Assumptions relating to application and disposal were conformant with the reference PCR. Pigment and resin data were taken from both ecoinvent v3.3 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.

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 2019 calendar year. Secondary data reflected the most up-to-date versions of the LCA databases mentioned above.

Geographic Coverage:

POWDURA® ECO is manufactured by the Sherwin-Williams Company primarily within the United States. Given that the facilities making POWDURA® ECO are spread across the U.S., the average U.S. grid mix was used in the LCA models as a conservative estimate. POWDURA® ECO 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 TRACI method was used and the LCIA results are formatted to be conformant with the PCR, which was based on ISO 21930:2017. The TRACI method is widely accepted for use in the United States. This method is also listed in the reference PCR.

Table 4. Overview of Impact Categories³

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). Biogenic carbon was excluded from the analysis as it was not relevant as stipulated by the PCR.
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 (NO_x) 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



The LCA results are documented and grouped separately below into the following stages as defined by ISO 21930:2017.

- Total Impact (across the entire cradle-gate lifecycle)
- Product Stage (Modules A1-A3)
 - A1 Extraction and Upstream Production
 - A2 Transport to Factory
 - A3 Manufacturing

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 impact categories were run for POWDURA® ECO and shown below in Tables 5-6 and resource metrics in Tables 7-8.

Table 5. Total LCIA Results

	PBS4-80R00	PBS9-80R00	PBT2-80R09	PDS4-80R00
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.02	5.68	4.36	3.98
IPCC AR6 GWP 100, incl biogenic CO2 [kg CO2 eq.]	3.98	5.64	4.32	3.93
Acidification (kg SO2 eq.)	0.013	0.018	0.015	0.013
Eutrophication (kg N eq.)	5.63E-03	7.71E-03	5.92E-03	5.76E-03
Ozone Depletion Air [kg CFC 11 eq.]	3.99E-07	5.62E-07	1.06E-06	4.38E-07
Smog Air [kg O3 eq.]	0.16	0.22	0.17	0.16

Table 5. Total LCIA Results (continued)

	PSZ4-80R00	PWS4-V0R00	PWS8-80R15	PWT2-V0R00
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.59	4.08	4.92	4.85
IPCC AR6 GWP 100, incl biogenic CO2 [kg CO2 eq.]	4.54	4.03	4.88	4.81
Acidification (kg SO2 eq.)	0.023	0.05	0.08	0.076
Eutrophication (kg N eq.)	6.53E-03	4.88E-03	6.04E-03	5.03E-03
Ozone Depletion Air [kg CFC 11 eq.]	4.23E-07	3.24E-07	4.19E-07	3.91E-06
Smog Air [kg O3 eq.]	0.21	0.18	0.21	0.21

Table 6. LCIA Results by Module

PBS4-80R00	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.65	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.60	0.18	0.20
Acidification (kg SO2 eq.)	0.012	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	5.57E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	3.99E-07	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.14	0.013	4.57E-03
PBS9-80R00	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	5.31	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	5.26	0.18	0.20
Acidification (kg SO2 eq.)	0.017	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	7.66E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	5.62E-07	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.20	0.013	4.57E-03
PBT2-80R09	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.99	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.95	0.18	0.20
Acidification (kg SO2 eq.)	0.014	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	5.87E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	1.06E-06	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.15	0.013	4.57E-03



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PDS4-80R00	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.61	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.56	0.18	0.20
Acidification (kg SO2 eq.)	0.012	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	5.70E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	4.38E-07	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.14	0.013	4.57E-03
PSZ4-80R00	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.22	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.17	0.18	0.20
Acidification (kg SO2 eq.)	0.022	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	6.47E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	4.23E-07	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.19	0.013	4.57E-03
PWS4-V0R00	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.71	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	3.66	0.18	0.20
Acidification (kg SO2 eq.)	0.049	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	4.82E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	3.24E-07	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.16	0.013	4.57E-03
PWS8-80R15	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.55	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.50	0.18	0.20
Acidification (kg SO2 eq.)	0.08	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	5.99E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	4.19E-07	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.19	0.013	4.57E-03
PWT2-V0R00	A1	A2	A3
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.48	0.17	0.20
IPCC AR6 GWP 100, excl biogenic CO2 [kg CO2 eq.]	4.44	0.18	0.20
Acidification (kg SO2 eq.)	0.075	7.41E-04	2.50E-04
Eutrophication (kg N eq.)	4.97E-03	4.03E-05	1.79E-05
Ozone Depletion Air [kg CFC 11 eq.]	3.91E-06	7.25E-12	5.89E-16
Smog Air [kg O3 eq.]	0.20	0.013	4.57E-03



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Figure 2. Averaged Powder Coating LCIA Impact Distribution by ISO 21930 Module

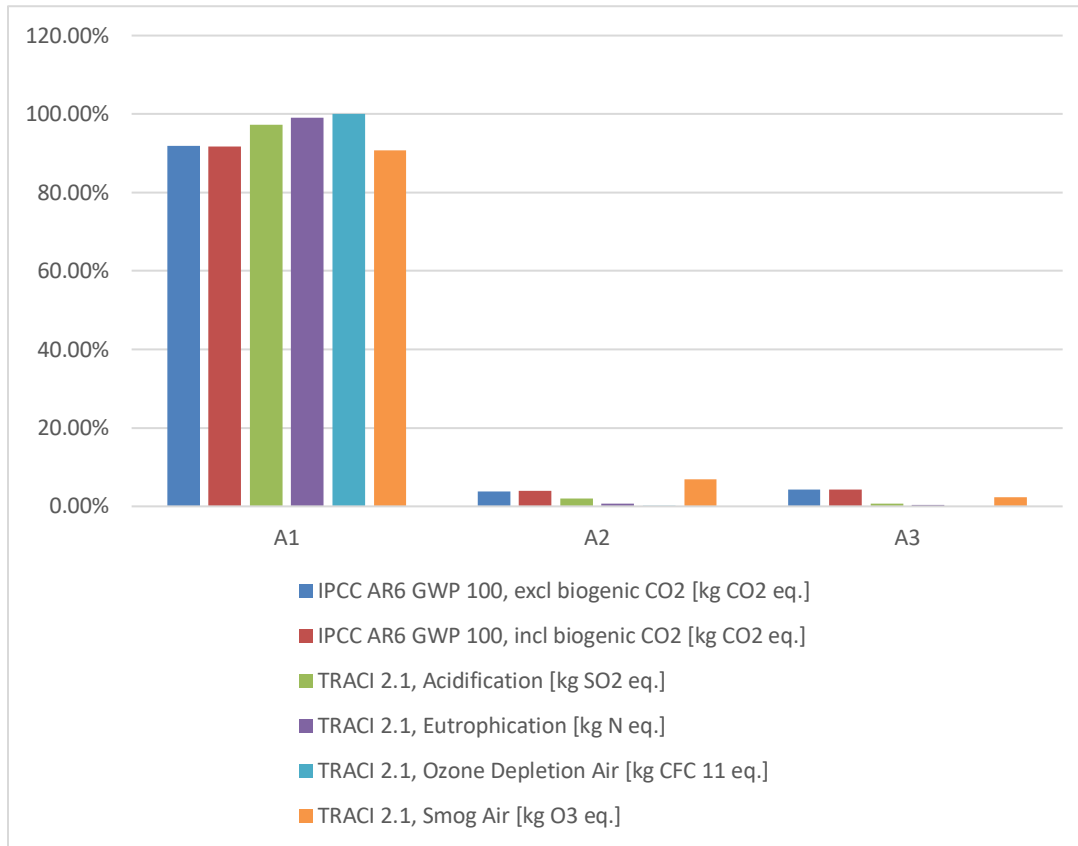


Table 7. Resource Metrics

Resource Metric	Total	A1	A2	A3
NRPRE (MJ)	90.45	84.68	2.47	3.30
NRPRE (kg)	2.18	2.04	0.059	0.079
RPRE (MJ)	5.58	5.26	0.00	0.32
RPRE (kg)	0.02	0.02	0.00	8.16E-09
Recovered Energy from disposal of waste in previous systems (MJ)	0	0	0.00	0.00
Abiotic Depletion Potential for Fossil Resources Used as Energy (MJ)	81.73	76.45	2.44	2.84
Abiotic Depletion Potential for Fossil Resources Used as Materials (kg Sb eq.)	2.44E-05	2.44E-05	7.96E-11	5.75E-08
Use of net freshwater resources (FW) [m3]	4.74	4.74	0.00	7.70E-04
SM (kg)	0	0	0.00	0.00
Recycled Material (kg)	0	0	0.00	0.00
RSF (MJ)	0	0	0.00	0.00
Non-renewable secondary fuels (MJ)	0	0	0.00	0.00
High-level radioactive waste (kg)	1.13E-06	9.12E-07	0.00	2.16E-07
Intermediate and low-level radioactive waste (kg)	1.04E-03	8.60E-04	0.00	1.80E-04

Table 8. Waste Generation Values and Data Sources⁴

Waste Generation		
Non-Hazardous Waste	.0059 kg/kg of product	Primary Data taken from average waste creation during Powder Coating manufacturing Plants in 2019.
Hazardous Waste	.0026 kg/kg of product	Primary Data taken from average waste creation during Powder Coating manufacturing Plants in 2019.



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⁴ Significant data limitations currently exist within the LCI data used to generate waste metrics for Life Cycle Assessments and Environmental Product Declarations. The waste metrics were calculated in a way conformant with the requirements of ISO 21930:2017, but these values represent rough estimates and are for informational purposes only. As such, no decisions regarding actual cradle-gate waste performance between products should be derived from these reported values.



Interpretation:

The majority of the environmental impact was from the raw materials used to make the coatings (Module A1) The raw materials with the largest impacts were the resins and primary pigment (often titanium dioxide). This was not surprising given the amount of resources needed to manufacture these intermediate products and also that they typically represent a substantial portion of the formulation (typically >60%).

Since the raw materials were responsible for the largest portion of the impact that the manufacturer could potentially optimize, product performance and durability will be critical important.

Generally speaking, the longer a coating lasts, the better its environmental performance will be.

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 and ecoinvent databases are widely accepted by the LCA community and CEPE's LCI Database is based off Sphera 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 very small amount of the overall formula (less than a percent) 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 noted in the Data Quality section of the LCA 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:

Since powder coatings are 100% solids, they do not contain VOC and therefore no expected emissions typically associated with coatings will occur. In addition, powder coatings are generally applied in a controlled factory setting where overspray can be captured and reutilized.

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:

Product Performance:

Although a declared unit was utilized for this EPD, it should be noted that higher quality powder coatings will generally last longer and/or require less coating to achieve the same hide as a more conventional powder coating. As such, coatings with higher performance may be characterized by significantly lower environmental impacts across the life cycle if less product needs to be used. Given this, users of this EPD data should consider product performance when making sustainability decisions.

Preferred End-of Life Options for Powder Coatings

Safe and proper disposal of excess materials shall be done in accordance with applicable federal, state, and local codes.



References:

American Coating Association Product Category Rule for Powder Coatings. Available at [via NSF International](#). Published June 2020.

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*.