Product Category Rule
for Environmental Product Declarations

RCMA PCR for Roof Coatings: NAICS 324122 & 325510 – 2026Ext

NSF Sustainability℠
National Center for Sustainability Standards

Program Operator

NSF International

National Center for Sustainability Standards

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No participation fees were charged by NSF to interested parties. NSF International ensured that reasonable balance among the members of the PCR committee was achieved and potential conflicts of interest were resolved prior to commencing this PCR development.

NSF International shall ensure that reasonable balance among the members of a PCR committee is achieved and potential conflicts of interest are identified. No participation fees will be charged by NSF International to interested parties for participation on PCR Development Committees, for attendance at PCR Development Committee meetings, or for commenting on a draft PCR document.

PCR REVISION HISTORY

Version	Date Issued
Version 1	July 2015
Version 2	July 2017
Extension (extends date of expiry, no additional changes have been made)	July 2022
Extension (extends date of expiry, no additional changes have been made)	June 2023
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ABOUT NSF'S NATIONAL CENTER FOR SUSTAINABILITY STANDARDS

Through the National Center for Sustainability Standards (NCSS), NSF International (NSF) develops life-cycle based, multi-attribute sustainability standards, protocols, and Product Category Rules (PCRs) for various industries including building products and materials, furniture, carpet and flooring, fabrics, wallcoverings, roofing membranes, green chemicals, and water and wastewater.

The NCSS will continue to add to its growing portfolio while providing education, outreach, and innovative support to private industry, trade associations, government and academia to foster a consensus-based approach toward conformity assessment in the sustainability field. Visit http://www.nsfsustainability.org or contact ncss@nsf.org.

To initiate your Life Cycle Assessment (LCA), receive your Environmental Product Declaration (EPD) verification, or have questions on where to start, contact NSF Sustainability at sustainability@nsf.org or 734-476-2543.

ABOUT ROOF COATINGS MANUFACTURERS ASSOCIATON (RCMA)

The Roof Coatings Manufacturers Association (RCMA) is the national trade association representing the manufacturers of asphaltic and reflective roof coatings and the suppliers to the roof coatings industry. RCMA has more than 70 members who manufacture in or ship products to almost every state in the country, and is headquartered in Washington, DC. Established in 1982, RCMA is a leading industry voice, promoting the benefits of roof coatings and providing its membership with up-to-date information on building codes and standards, technical developments, and other industry topics of interest. The high level of participation and dedication from the membership is a testament to RCMA's commitment to representing the industry, and to promoting the wide range of benefits roof coatings offer.

1 GENERAL INFORMATION

This PCR documents the goal and scope of LCAs for this product category in order to produce environmental product declarations according to ISO 14025 and ISO 21930. The PCR includes all life cycle phases in order to obtain the raw materials, manufacture, transport, use, and disposal of liquid applied roof coating products for exterior applications. The definition of a liquid applied roof coating is specifically outlined in section 1.1 and generally is a coating for field application to roofs for maintenance, repair, or as a component of roof assembly. The scope excludes adhesives and coatings solely for shop applications, original equipment manufacturing, or application to non-stationary structures, such as vehicles, airplanes, ships, boats, and railcars. Finally, this PCR does not include coatings that fall under the American Coating's Associations PCR for Architectural Coatings. This PCR is valid through June 17, 2026.

1.1 Roof Coating Industry Classification

The roof coatings industry, as represented by the Roof Coatings Manufacturers Association (RCMA), has developed a definition for roof coatings. For the purposes of this PCR, a roof coating is defined as "a fluid-applied and adhered coating used for roof maintenance, roof repair, or as a component of a roof covering system or roof assembly". Roof coatings can be further classified by the subcategories below:

- **Primers:** materials applied to a surface to promote adhesion between the substrate and subsequent coats.
- **Basecoats:** coatings applied to the surface after preparation and before the application of a finish coat.
- **Fabric/Mechanical Reinforcement** Layer: an optional layer of typically polyester fabric that mechanically reinforces the coating system around its perimeter or edges. Typically, these layers are applied on 5%-10% of the entire roofing surface area.
- **Topcoat:** the final layer of coating put onto a surface over another layer(s).

Roof coatings shall be assessed as a product system as opposed to individual coatings or layers. For example, roof coatings are typically made up of at least a basecoat and a topcoat. Some systems may also utilize reinforcing fabric, typically around the system's perimeter or edges. As such, EPDs shall consider all coatings needed to achieve the desired coating coverage and performance and not just one of these components. An example of a

roof coating system as shown below in Figure 1.

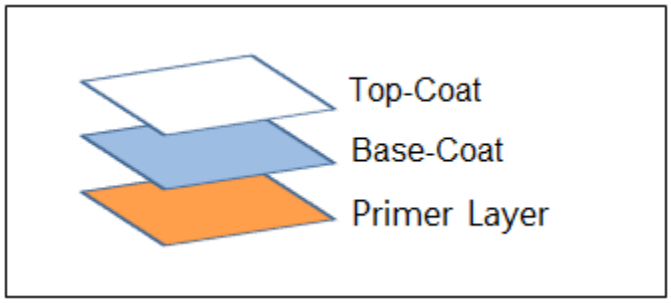

Figure 1 - Example of a Roof Coating System with 3 Layers.

Note: it is possible for a roof coating system to require a different number, or types of layers, or both than what is represented above.

Roofing covers, or membranes, or both are **not eligible** for inclusion under this PCR.

Eligible products will be further classified by specific functionality in section 3.3 of the PCR.

1.2 Information

This document specifies the requirements for the Life Cycle Assessment (LCA) study as well as the format and content of the EPD itself. Recognizing the regional nature of LCA and the coatings industry, this PCR was designed to be applicable for the United States, but could be utilized elsewhere if desired. However, since this PCR has been written with United States assumptions in mind, any EPDs should clearly state that the reference PCR was not necessarily designed for their region.

The PCR Committee reviewed existing coating PCRs published by the International EPD System[1], UFON Nano-Chemical Corporation[2], and the Institut Bauen und Umwelt e.V. [3] These PCRs for coatings were found not to meet the specific scope of this PCR. This PCR improves the classification for roof coating product categories, the functional unit of roof coatings, and various regional assumptions. For example, existing PCRs assumed a

[1] <http://www.environdec.com>

[2] <https://www.cens.com>

[3] <https://ibu-epd.com>

functional unit of 1kg of coating which is improper given the various performance differences between products or included products such as thinners and solvents under the same product category. The PCR Committee used the American Coating Association's PCR for Architectural Coatings as a foundation for the Roof Coatings PCR, but modified assumptions surrounding functional unit, application, performance, and composition to be specifically relevant for roof coatings. This reflects that the ACA's PCR for Architectural Coatings has been embraced by the coatings industry as a whole and much of its framework could be leveraged into the Roof Coatings PCR.

The PCR Committee also referenced and utilized findings from LCAs and EPDs conducted by members of the Committee to inform its assumptions. While these LCAs were not necessarily specific to roof coatings, strong similarities do exist between these LCAs/EPDs and the manufacturing, composition, and application of certain roof coating types. For example, acrylic roof coatings are chemically similar to acrylic paints. As such, these were a crucial resource and helped inform key assumptions and identify hotspots. Finally, RCMA had previously commissioned a LCA from Stanford University which was also used as a resource.

The PCR document was prepared by NSF International (the program operator) and the Roof Coating Manufacturer's Association Product Category Rules Task Group in accordance with ISO 14025. An open enrollment period was provided to seek out stakeholders interested in being part of the PCR creation. A multi-stakeholder group composed of roof coatings industry personnel, material manufacturers, and other experts worked to create the PCR.

The PCR at hand was formally developed by a panel of representatives of RCMA members and U.S. roof coatings manufacturers, standards development groups, environmental consultants, and other interested parties and conforms to ISO 21930 requirements. This panel interacted with NSF International and members of the Roof Coating Manufacturer's Association. Additional requirements lie in the validation of coating service life by conforming to the requirements of various testing standards described in this PCR. Appropriate life cycle impact assessment (LCIA) methodologies were selected based on manufacturing region and will be addressed herein.

2 PRODUCT DESCRIPTION

The product description shall include the name of the product, product manufacturer, product model number, a general description, and a picture of the packaged product as sold in the United States. If the EPD covers a range of products or multiple SKUs of the same product, the general description needs to cover all of them while the picture should be labeled as an example and clearly identify the specific product being displayed.

Products within the same product lines (for example, items that share the same product name, but have differing colors) may be included in the same declaration, provided that the impacts for each of the different product variations are also included within the EPD. This will allow for more effective dissemination of EPD results.

3 GOAL AND SCOPE REQUIREMENTS FOR THE LCA STUDY

3.1 Goal Definition

The goal of this PCR is to specify the guidelines for developing a Type III Environmental Product Declaration (EPD) in conformance with ISO 21930 and 14025, based on an ISO 14040 and ISO 14044 conformant LCA study.

The goal of an LCA study conforming to this PCR shall be, at a minimum, to identify the potential environmental impacts of each life cycle phase of the product, or enable product improvement over the full life cycle of the product, and shall be presented in such a way as to be relevant to the public or for internal company use.

Any EPD comparisons derived from the use of this PCR shall be conducted in respect to its utilization and function as a building product and be conformant with ISO 21930, Clause 5.6.

The scope of the LCA shall include a description of the following according to this PCR:

- Functional Unit [3.2]
- Criteria for inclusion of inputs and outputs (cut-off rules) [3.6]
- System Boundary [4]
- Description of data [4.1-4.4]

- Units and quantities [6]
- Data quality requirements [7]

3.2 Functional unit

The functional unit shall be 1m^2 of covered and protected roofing membrane[4] for a period of 20 years (the expected roof system lifespan extension provided by the coating). Coatings shall exhibit an appropriate thickness (based on its technology type and defined by the manufacturer's published application guidelines) and reflectance for its color, or technology, or both after drying.

This PCR applies to roof coatings that provide the function described by the functional unit. Additional functions that the product may provide are not considered herein.

3.3 Reference flow

The reference flow shall be the amount of product needed to satisfy the above functional unit. In order to satisfy the functional unit, multiple coats or recoatings may be needed. If the technical lifespan of a coating does not cleanly divide into the functional unit (e.g., a coating lasts 15 years), recoats shall be rounded up to the nearest two decimal places. As such, a coating that lasts 15 years would require 1.33 recoats to satisfy the 20-year lifespan in the functional unit and not just 1 or 2 recoats. It is also common for roof coating systems to be made up of multiple coating layers (see Figure 1 above). If this is the case, then the entire coating system needed to achieve full performance and coverage shall be included and disclosed in the EPD.

Thickness shall be computed using volume solids and published spreading rate.

When determining product lifespan, the design life shall be used and reported by the EPD. In order to determine a design life, the product shall be classified by their expected service life as 'typical' or 'high performance' for the technology. Expected service life is based on the product meeting various accepted industry durability tests. Additional information is provided below.

[4] Coverage and protection attributes are defined in section 3.3.

All lifespan values in Table 1 were developed through industry consensus and are consistent with values found in publicly available literature and manufacturer claims. If a coating is a hybrid of multiple technologies (which could include use of a fabric layer in an otherwise liquid coating system), it shall use the lifetime based on the technology of the ASTM or other eligible testing methods it references for its performance claims. If no eligible testing is completed, than it shall use the lowest service life of the technologies it hybridizes.

Table 1. Design Life by Coating Type and Quality Designation.

Coating Type	Typical Service Life	High Performance Service Life
Acrylic Roof Coating	7 years	15 years
Silicone Roof Coating	15 years	25 years
Asphaltic Roof Coating	3 years	7 years
Polyurethane Roof Coating	10 years	20 years
Aluminum Roof Coatings	3 years	7 years

The EPD shall provide information for the entire coating system. The product or range of products shall denote which service life of roof coating function that the unit represents. A coating system designated as 'high performance' has a corresponding ASTM test it shall meet to be classified as such. Table 2 shows the relevant ASTM methods. These tests were selected as they are already cited in the International Building Code 2015. **However, regional variations in the test that meet the intent of the building code are also acceptable.** For example, if the product meets a variation of the test that occurs for a specific region (but is still designed to be equivalent to IBC 2015), then it would still qualify. This does occur in certain regions with special climates or that require specific performance attributes for roof coatings.

The respective test should be administered either internally by the reporting company or by a third-party. ***A product shall meet the thresholds of all the tests in the ASTM method to qualify as high-performance. If the product does not satisfy all of the testing requirements, then it shall use the 'typical' service life for its coating type shown in Table 1.***

Table 2. High Performance Classification Requirements.

Coating Type	Requirements for High Performance Classification
Acrylic Roof Coating	Meet ASTM D6083 Specifications
Silicone Roof Coating	Meet ASTM D6694 Specifications
Asphaltic Roof Coating	Meet ASTM D1227 Specifications
Polyurethane Roof Coating	Meet ASTM D6947 Specifications
Aluminum Roof Coating	Meet ASTM D2824 Specifications

If no eligible performance tests have been conducted, the product shall use the 'typical' design life for the purposes of the EPD.

3.5 Colorants

Roof coatings are not typically formulated to be tinted at point of sale. As such, pigment/colorant impacts will already be captured in the LCA model of the formula itself. This is a key difference between conventional architectural coatings and roof coatings.

3.6 Cut-off rules

Cut-off rules shall be as described in ISO 21930 clause 6.2.7.2. A minimum of 95% of the total mass, primary energy, and environmental relevance for the system shall be captured.

For materials characterized as hazardous by the Globally Harmonized System (GHS), cut-off rules do not apply and such substances shall be included in the inventory.

4 SYSTEM BOUNDARIES

The system boundary of EPDs shall at a minimum be consistent with ISO 21930 6.2.5. EPDs shall include all life cycle phases, from cradle-to-grave. All relevant inputs shall be included in LCA models with the exception of:

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

The rationale for excluding these areas is that they have been determined by internal LCAs conducted by RCMA member companies to represent a negligible environmental impact in the overall life-cycle performance of a coating. These assumptions are also consistent with other LCA frameworks such as the Product Environmental Footprint (PEF) program under development by the European Commission in the European Union.

In the case of the coating applicator, it is not practically feasible to estimate impacts given the variety of application techniques. For example a roller or spray applicator could be used to coat 100m^2 of substrate or 10m^2. As such, there is no reliable way to account for this impact in terms of the functional unit. However, screening LCAs conducted by coatings manufacturers estimate that this impact is minimal relative to the overall lifecycle impacts of roof coatings and would not significantly impact EPD results. For these reasons, the PCR committee excluded the applicator from the LCA model.

It should also be noted that certain aggregated LCI data sets used to generate the EPD may not include all relevant flows. These differences should be noted in the data quality assessment discussed in section 7.2.

Based on the discussions by the PCR development committee, it is believed that no significant data gaps are present in the PCR.

Figure 2 illustrates which processes are relevant for completion of the EPD.

Life Cycle Stages

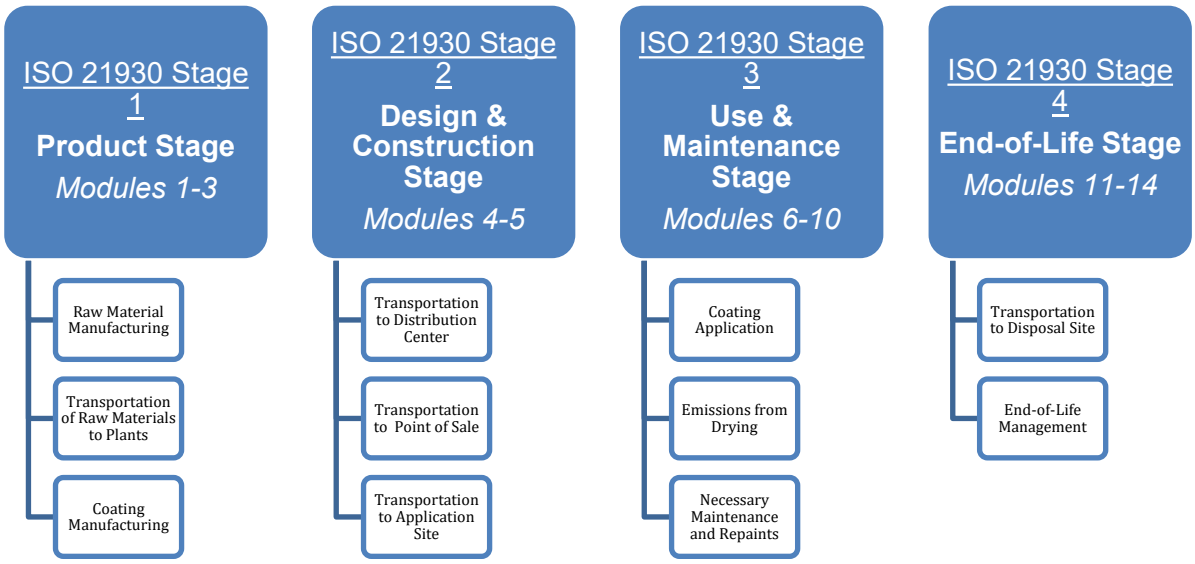

Figure 2 — Relevant system boundaries, information modules and life-cycle stages of building products

4.1 Stage 1- Product Stage (ISO 21930 Modules 1-3)

The material acquisition, pre-processing, intermediate processing, and processing stage (product stage) starts when the raw materials are extracted from nature (e.g. titanium dioxide ore), and ends when the intermediate materials (e.g., butyl acrylate, titanium dioxide pigment, etc.) reach the gate of the production facility and are processed into the final coating product and packaged for shipping. During production, the product undergoes the transformation from intermediate material to the final coatings product; additionally, any co-products or wastes formed during production shall be accounted for in this stage. Processing differs depending on the roof coating technology. For example, acrylic roof coatings are typically made by adding measured amounts of ingredients into a high-speed disperser for mixing. Once the ingredients are mixed, the product is let-down or thinned and then filled into containers which are sealed. Other coating technologies may have different or additional steps and they shall be accounted for in the Product Stage.

Materials can be considered either “primary” or “secondary”.

- Primary raw materials are 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 roof coatings (e.g., pigment, solvents).

- Secondary raw materials are recovered, reclaimed, or recycled content that is used to create basic materials for the production of roof coatings (e.g. aluminum scrap).

- Intermediate processing is the conversion of raw materials to intermediates (e.g. titanium dioxide ore into titanium dioxide pigment, etc.).

- The following shall include the materials and energy use along with the transportation to the point of use:
  - Production of the final coating by mixing of the ingredients or intermediates;
  - Catalysts or other ancillary materials used during production;
  - Primary packaging of the final product.

Inbound transportation shall be included in the life cycle inventory for the processing stage. All transportation, including inter-facility transport, prior to the material being shipped to the production stage shall also be included.

If more than one primary data point is available for inbound transportation distances of a raw material, an average distance weighted by the transported mass may be calculated and the methodology disclosed in the EPD. If primary data is not feasibly obtainable, transport distances listed in Table 7 shall be used for inbound raw material transports to facilities located in the United States. For processes outside of the United States, appropriate regional or national transportation distance and mode(s) shall be used where primary data is unavailable. If different vehicle classes or more than one transportation mode is required, then the LCA model shall use multiple transportation datasets to represent these, provided that separate LCI datasets are available for these vehicles, or modes, or both.

Waste and scrap created during raw material manufacturing and emissions associated with transporting them to point of disposal shall be accounted for. Primary data for stage 1 shall be used, if available, otherwise secondary data shall be used. Secondary data may come from any credible and relevant national or regional databases, or

from commercially available life cycle inventory data such as GaBi or ecoinvent. See section 7.2 for information relating to data quality guidelines. In the United States, the 2012 EPA Waste Reduction Model (WARM model) gives an average transport end of life distance as 20 miles. This value shall be used for manufacturing facilities located in the US when primary data or other representative data are not available, and waste transports are not included in the secondary dataset.

Waste and scrap created during production ("post-production") shall be included in the LCA model. Primary data on process yields and scrap rates shall be used if available. If waste materials are recycled, landfilled, combusted, or composted, the transportation distances shall use the 20 mile value mentioned above [USEPA Waste Reduction Model (WARM)] for the United States, and the appropriate regionally or nationally representative value outside of the United States unless primary data has been obtained, in which case the primary data shall be used.

Material recycling percentages for the US shall be based on USEPA Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures (current version).[27] Outside of the US, regionally or nationally appropriate recycling rates shall be used.

Table 7: Material Transport Distances from 2007 U.S. DOT Shipment Characteristics by SCTG Code:[5]

Raw Material/ Classification grouping		Distance (miles)		
		Rail	Truck*	Water
Raw Coating Materials	Any material used in a coating where no primary source data is available.	0 miles	750 miles	0 miles
Plastics (inc. polymer-based materials; exc. textiles)		0 miles	757 miles	960 miles
Steel (for packaging)	32 Base metal in primary or semifinal forms & in finished basic shapes.	562 miles	932 miles	833 miles

4.2 Stage 2 - Design and Construction Process Stage (ISO 21930 Modules 4-5)

The design and construction process stage starts with the packaged and finished coating leaving the production site and ends with the finished coating being delivered to the application site.

During this stage, the finished product is moved from a shipping dock for distribution. The product is then transported to a distribution center where it then is shipped to the point of sale. The end gate is the application site after the purchaser acquires the finished product and transports it to the application site.

A coating may go though many facilities before delivery to point of sale. Several legs of distribution and storage may occur for one roof coating, e.g., storage at a distribution center, installer warehouse, and a retail location.

[5] NOTE: The average transport distances could also be used for complete components or units.

NOTE: Oceanic distances were approximated. For materials where a particular mode of transport was not typical or common, it was assumed to be zero (e.g. rail transport for plastics in North America).

*Truck distance listed in round trip, as the assumption is made that the delivery truck returns empty after making the delivery.

Product distribution and storage includes processes such as facility operations and transportation between facilities. This stage includes the transport of components or semi-finished products between processes, or facilities, or both.

Intercompany movement shall be accounted for where facilities fall under operational control of the reporting company. For facilities not under operational control of the reporting company, estimates should be made and disclosed if primary data is not feasibly obtainable. Transportation mode(s) and distances shall be based on primary data. If primary source data is not feasibly obtainable, the distances in Table 8 shall be used in the LCA study. Outside of the US, regionally or nationally appropriate transport distances and modes shall be used.

Table 8: Transport Distances in Design and Construction Process Stage[i]

Raw Material/ Classification grouping		Distance (miles)			
		Rail	Truck*	Passenger Vehicle (Single-Trip)	Water
Finished Products to Distribution Center	Any finished product where no primary source data is available.	0 miles	250 miles	0 miles	0 miles
Finished Products from Distribution Center to Point of Sale.	Any finished product where no primary source data is available.	0 miles	500 miles	0 miles	0 miles
Finished Products from Point of Sale to Application Site.	Any finished product where no primary source data is available.	0 miles	0 miles	5 miles	0 miles

4.3 Stage 3 - Use and Maintenance Stage (ISO 21930 Modules 6-10)

The use stage begins when the user applies the product to a substrate and ends with any leftover coating and discarded packaging entering the end-of-life stage. It shall also be assumed that 10% of the wet mass of the coating

remains unused and is properly disposed[6]. For many roof coatings, the application does not require energy or generate smog-forming emissions (e.g., no-VOC coatings); for these products, maintenance and recoats may be the only major processes.

For roof coatings specifically formulated to be spray-applied, an application-efficiency shall be estimated and disclosed in the EPD as well as used for all relevant calculations.

Emissions released from the drying of the coating shall be modeled as individual releases. However, if the exact emissions from drying are unknown, they shall be modeled as generic non-methane volatile organic compounds (NMVOCs).

Typical processes to be included for the use stage are:

- Normal application (including drying/curing); and
- Necessary recoats and maintenance occurring during the usage time of 20 years.

As mentioned in section 3.3, multiple coats, /or recoats, or both may be needed to satisfy the functional unit stated in Section 3.2.

4.4 Stage 4 - End-of-life Stage (ISO 21930 Modules 11-14)

The end-of-life stage begins when any applied or unused coating and primary packaging is ready for disposal, recycling, reuse, etc. and ends when these products are landfilled, returned to nature (deterioration), or transformed to be recycled or reused. Processes that occur as a result of the disposal are also included within the end of life stage. End-of-life processes may include:

- Collection of post-consumer coating, other unused coating, and primary packaging;
- Incineration; and

[6] See U.S. Environmental Protection Agency Report: *Quantifying the Disposal of Post-Consumer Architectural Paint* (April 2007).

*Truck distance listed in round trip, as the assumption is made that the delivery truck returns empty after making the delivery.

– Landfilling, landfill maintenance, decomposition emissions.

Based on data from the coating industry's PaintCare® program, it shall be assumed that waste coatings travel 7 miles by passenger vehicle to the point of disposal. It shall also be assumed that 100% of waste water-based coatings are sent to landfill and 100% of waste solvent-based coatings are incinerated for energy recovery[7]. Energy generated from incineration shall be credited using the Avoided Burden Method[8] consistent with the Allocation Rules in section 5.

Any coating applied to the substrate shall be treated as incremental mass at end-of-life, and shall be disposed via the appropriate end-of-life channel(s) based on primary source data for that specific product type. If data is not feasibly obtainable or is unavailable, it shall be assumed that the waste coating is sent to landfill. This reflects that once a surface is coated, it is rarely removed through chemical or mechanical means and instead is coated-over and then eventually disposed with the substrate. Transportation distances shall be taken from the default values from the most recent version of the USEPA WARM model.

In the absence of primary data on actual end-of-life treatment for the packaging materials, the most current version of the USEPA Municipal Solid Waste (MSW[25]) data, USEPA WARM model, or surrogate (shall be identified in the EPD) for the United States, or another regionally or nationally appropriate data source shall be used outside of the United States to determine the percent of each material in the packaging that can be recycled versus landfilled. The amount of each material in the packaging that can be assumed to be recycled versus disposed of is determined by multiplying the EPA MSW within North America, or other appropriate regionally or nationally applicable model, recycling rate (in %) by the amount of each homogenous material type that is disassembled. The remaining materials that are not recycled should be modeled for end of life using 82% landfill and 18% incineration[9].

See Figure 3 below for additional information for modeling recycling processes.

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[7] See <http://www.paintcare.org/wp-content/uploads/docs/ca-annual-report-2014.pdf>

[8] An overview of the Avoided Burden Method can be seen at:< http://www.lcaforum.ch Portals/0/DF_Archive/DF33/Frischknecht%20-%20ESU-services%20-%20LCA%20DF33.pdf>

[9] The usage of 82%/18% is a general disposition determined by the US EPA in the "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks" document, page 111, and is deemed to be an acceptable disposition rate of final materials.

5 ALLOCATION RULES

Where possible, allocation should be avoided by dividing unit processes into two or more sub-processes (as specified in ISO 14044-2006, Section 4.3.4, Allocation), or through expansion of system boundaries to include the additional functions of co-products or substitution. If allocation cannot be avoided, the following hierarchy of allocation methods is preferred:

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

Deviation from these allocation rules shall be documented and justified.

For allocation due to recycling or energy recovery, the avoided burden approach shall be applied as 'net scrap'. Avoided burden should be defined using the equation 'Avoided Burden = (Material Recycling Rate) × (Functional Unit) × [(Impact of Virgin Production) − (Impact of Recycling)]'. This equation should only apply to packaging end-of-life streams.

Figure 3 illustrates a simplified process map for a product that uses the Avoided Burden Method as it relates to coating manufacturing.

Avoided Burden Process Map

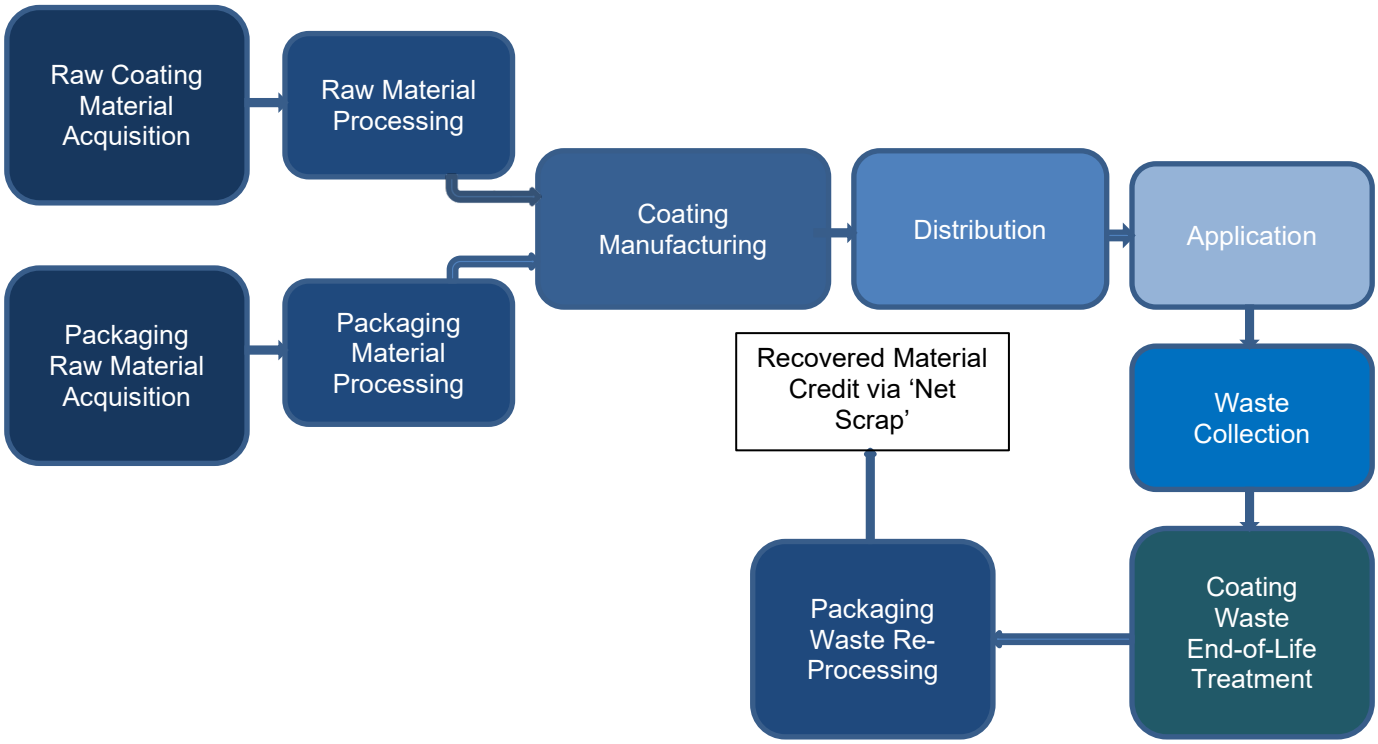

Figure 3 - Process Map Illustrating Avoided Burden Approach to Recycling.

6 UNITS AND QUANTITIES

International System of Units (SI units) shall be used for both the LCA and the EPD. Quantities shall be represented with three valid digits expressed in scientific notation.

7 CALCULATION RULES AND DATA QUALITY REQUIREMENTS

7.1 Types and sources of data

Primary data (site specific or representative averages) shall be used for facilities and processes under operational control of the reporting company. However, generic data may be used for facility operations that contribute less than 10% of the total production output of the product being reported by the EPD. If unable to meet this threshold, justification for the inability to obtain primary data shall be disclosed in the EPD. For facilities and processes outside of the operational control of the reporting company, secondary data may be used. For products that are manufactured wholly or largely outside of the reporting company control (e.g., contracted products or significant assemblies), primary data are highly encouraged; however, representative secondary data may be used in lieu of primary data.

7.2 Data quality

A data quality assessment shall be made for the system under study and included in the EPD. All data shall be accurate, complete, and representative of the manufacturing process, current technology and current measurement capability. The data shall be consistent with the following requirements:

1. The information obtained from the manufacturing process(es) shall be average annual values per functional unit, and it shall not be more than five years old. Any secondary data that is used shall be less than five years old. If data older than five years is used from a secondary source, justification shall be included to address why newer data are not available.
2. Data should represent the technology(ies) and process(es) in current use.
3. Data quality assessment shall conform to ISO 14044, Section 4.2.3.6.
4. Data quality assessment shall, at a minimum, address the following:
    a) time-related coverage: age of data and the minimum length of time over which data was collected;
    b) geographical coverage: geographical area from which data for unit processes was collected to satisfy the goal of the study;
    c) technology coverage: specific technology or technology mix; and
    d) uncertainty of the information (e.g., data, models and assumptions).
        a. May include quantitative estimation of uncertainty (optional).

5. Suitable data quality assessment frameworks include (but are not limited to):
    a) USLCI Data Guidelines[10]
    b) ILCD Handbook[11]
    c) Table 8.2: Criteria to Evaluate the Data Quality Indicators, WRI product standard[12]

7.3 Data sources

All data sources used to create the EPD shall be documented and disclosed. In addition, given their prominence in the environmental impact of a coating, sources of LCI data sets used to represent the manufacturing of raw materials,/or intermediates, or both in the pigment and binder(s) manufacturing processes shall be disclosed separately.

Primary source data should be used whenever feasible and available for any and all processes.

If the most recent version of an LCA database is not used to create the EPD, written justification for its exclusion shall be provided and properly reflected in the data quality assessment following section 7.2. Any use of generic data shall be justified, consistent with ISO 21930 clause 6.2.6.

The EPD shall assess and disclose any significant data gaps that occur.

7.4 Electricity modeling

To avoid double-counting, regional (i.e., sub-country level) or national average consumption mixes, which account for power imports into the respective region, should be used to model electricity consumption. If this data is unavailable, then production mixes at the regional or national level should be used as long as the implications are properly reflected in the data quality assessment following section 7.2.

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[10] <http://www.nrel.gov/lci/docs/dataguidelinesfinalrpt1-13-04.doc>

[11] <http://bookshop.europa.eu/fr/international-reference-life-cycle-data-system-ilcd-handbook-general-guide-for-life-cycle-assessment-detailed-guidance-pbLBNA24708/downloads/LB-NA-24708-EN-C/LBNA24708ENC_002.pdf;pgid=y8dIS7GUWMdSR0EAIMEUUsWb0000YvMK-6Wt;sid=02ZBuqZp_GlBrvSwWXTfHcRMcaU96qG61bU=?FileName=LBNA24708ENC_002.pdf&SKU=LBNA24708ENC_PDF&CatalogueNumber=LB-NA-24708-EN-C>

[12] <http://www.wri.org/sites/default/files/pdf/ghgp_product_life_cycle_standard.pdf>

Carbon offsets or Renewable Energy Credits or Certificates shall not be accounted for in the inventory. These refer to credits purchased for processes not under the control of the purchaser. For example, a coal fired power plant might buy carbon credits that support the planting of forests, or might buy Renewable Energy Credits that support the installation of renewable energy at distributed locations. While these activities can and should be accounted for on a corporate level, they should not be applied to the product LCA underlying the EPD.

On-site renewable energy from solar cells or other renewable energy sources may only be accounted for in the inventory if the generated electricity is not uploaded to the grid.

7.5 LCIA methodology

The following environmental impact categories shall be disclosed in the EPD per functional unit.

1. Climate change (GWP 100 years) [kg CO_2-eq.]
   IPCC (AR5); Biomass carbon uptake and its re-release of CO_2 and CH_4 shall be reported separately based on the biogenic carbon content of the product to be declared.

2. Acidification of land and water sources (AP) [kg SO_2-eq]
   TRACI 2.1; outside North America, regionally applicable methodologies.

3. Photochemical ozone creation (SFP, or “Smog Formation”) [kg O_3 eq. / kg of emission]
   TRACI 2.1; or outside North America, regionally applicable methodologies.

4. Eutrophication (EP) [kg N eq. / kg of emission]
   TRACI 2.1; or outside North America, regionally applicable methodologies.

5. Depletion of stratospheric ozone (ODP) [kg CFC-11 eq. / kg of emission]
   TRACI 2.1; or outside North America, regionally applicable methodologies.

These impact categories are consistent with those stated in ISO 21930 section 8.2.2.1.

7.6 Sensitivity analysis

Given the relevance of the coating's assumed durability as well as its effect on cooling loads over the lifetime of a building, most assumptions in this PCR will have a minimal impact on the overall results of the EPD. Since the industry has gone to great lengths to define the crucial assumptions using industry best practices and nationally accepted testing frameworks, no additional sensitivity analyses are required for the creation of the EPD. However, they should be conducted and included if desired.

8 PARAMETERS TO BE DECLARED IN THE EPD

Standards referenced in the EPD shall be the most recent version required at the time of the LCA. LCI data and impact assessment results shall be declared in the EPD as detailed below. A template of the information required for disclosure in the EPD is also provided in section 13.

8.1 Material composition

Specifications as required by SDS (Safety Data Sheets), such as reporting certain aspects of material composition of the assessed coating product(s), shall be disclosed in percentage of total weight.

Per ISO 21930 8.1, ingredients or compounds that are proprietary and covered by intellectual property rights or similar legal restrictions do not have to be disclosed in the EPD.

8.2 Life cycle inventory data

The following life cycle inventory analysis results shall be reported by life cycle stage (Fig. 2) and as totals:

1. Depletion of Non-Renewable Energy Resources (MJ)
2. Depletion of Non-Renewable Material Resources (kg)
3. Use of Renewable Primary Energy (MJ)
4. Use of Renewable Material Resources (kg)

5. Consumption of Freshwater[13] (m^3)

The resource metrics listed above shall be determined by assessing their totals across the LCIs used in the LCA models. LCA tools such as SimaPro and GaBi make such metrics available in the balance of the LCA.

Renewable energy sources are defined as renewable non-fossil energy sources: wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.

Renewable material resources are defined as ones that can be readily replaced by natural means on a level equal to their consumption.

The waste allocated to the building product for the foreground system (the operations under direct control of the product manufacturer) shall be classified in the EPD as

1. Hazardous waste[14] or
2. Non-hazardous waste

The division between the various waste categories **shall be expressed in percentage terms** rather than reporting a total mass. Reporting waste metrics in this way avoids the bias introduced by inconsistent coverage and classification of hazardous and non-hazardous wastes in third-party data.

8.3 Declaration of Potential Environmental Impacts

Life cycle impact assessment category indicator results shall be reported separately for the product stage, design and construction stage, use and maintenance stage, and end-of-life stage, as well as the total life cycle results. Users shall report impact category results for each individual coating layer as well as total impact category indicator results for the entire product system in the LCA Report. However, reporting impact category indicator results by individual coating layer in the EPD is optional. Total impacts for the entire product system and for each ISO 21930 life cycle stage shall still be reported in the EPD as well.

[13] This metric represents the net value between uptake and re-release, hence accounting only for evaporation and other forms of water displacement.

[14] As defined by RCRA under 40 CFR 261.33

Impact categories shall use the characterization models specified in Section 7.5 of this PCR. The impact category indicator results shall be reported separately for the product stage, design and construction stage, use stage, and end-of-life stage as well as total life cycle results as described by sections 4.1-4.4.

1. Climate Change [kg CO_2-eq.]
2. Depletion of the Stratospheric Ozone Layer [kg CFC-11 eq. / kg of emission]
3. Acidification of Land and Water Sources [kg SO_2-eq]
4. Eutrophication [kg N eq. / kg of emission]
5. Formation of Tropospheric Ozone (Photochemical Oxidants) [kg O_3 eq. / kg of emission]

8.4 Emissions to Water, Soil, and to Indoor Air

Per ISO 21930, Section 8.2.3, any releases to ground- and surface water and indoor air shall meet all relevant national standards. VOC emissions occurring during the use phase shall be declared in the EPD, measured in a way consistent with industry best-practice. The employed VOC testing method shall be disclosed in the EPD.

9 ADDITIONAL ENVIRONMENTAL INFORMATION

EPDs developed using this PCR shall include, where relevant, additional information related to environmental issues, other than the environmental information derived from LCA, LCI or information modules. This information shall be separated from the information described in ISO 21930, 8.2.2.1, 8.2.2.2, and 8.2.2.3. Identification of the significant environmental aspects should conform to ISO 21930, 8.2.4 and ISO 14025 7.2.4. EPDs may also include expected energy savings, benefits of roof lifetime extension, and the effects of emissions on human health and toxicity as described below.

For reflective roof coatings, expected energy savings may be reported against an appropriate baseline scenario. Expected energy savings as compared to an appropriate baseline value shall be calculated for each of the three climate scenarios listed in the Energy Star v3 standard. The locations that shall be used to represent each climate scenario are Phoenix, AZ, Cleveland, OH, and Miami, FL.

Both solar reflectance and aged solar reflectance shall be considered. When calculating energy savings, the US Department of Energy's (DoE) Oak Ridge National Laboratory tool shall be used[15].

When using this tool, the annual average version shall be used as opposed to the peak energy version. The generated energy values shall be reported in the EPD against a baseline scenario. The baseline scenario shall be defined, at a minimum, as using the DoE's average values for each roof characteristic for a black roof in each of the three climate scenario locations listed above. However, the EPD may include a more stringent baseline scenario if desired. The specific baseline scenario utilized shall be disclosed in the EPD. The reported results of these scenarios run using the DoE tool shall be disclosed in the EPD if expected energy savings are to be reported.

Since roof coatings extend the life of existing roofs and prevent tear-offs, the following statement may be included to generally discuss the environmental advantages of using a roof coating versus other approaches. This statement shall be revised by the PCR Committee and Drafting Team once adequate LCA/EPD data for roofing becomes publicly available[16].

The application of a roof coating can help extend the service life of an existing roof and prevent a roofing tear-off. A typical roofing tear-off generates a significant amount of waste per m^2. As such, generation of this waste can be delayed or even avoided by the application of an appropriate roof coating as directed. The avoided waste burden from using a roof coating may create eligibility for LEED credits. The volume of waste generated varies by type of roof, number of layers, and insulation thickness.

For example:

- A multi-ply asphaltic roof with 4 inches of insulation generates approximately 3,600 ft^3 of waste / 10,000 ft^2
- A multi-ply asphaltic roof with 6 inches of insulation generates approximately 5,200 ft^3 of waste / 10,000 ft^2
- A single-ply roof with 4 inches of insulation generates approximately 3,300 ft^3 of waste / 10,000 ft^2
- A single-ply roof with 6 inches of insulation generates approximately 4,900 ft^3 of waste / 10,000 ft^2

Because the roofing, or physical membranes, or both themselves are not covered by this PCR, any information

[15]The tool is available at http://web.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm

[16] This is expected sometime in Q3 2016.

pertaining to the specific disposal, handling, etc., requirements of these materials shall be acquired directly from those relevant products, or their manufacturers, or both.

EPDs may report impacts related to human health, the environment, or both using the USEtox method. This may be reported in terms of the five largest contributors to the USETox indicator, together with a brief assessment of the emission data uncertainty of the unit processes where these contributors occur.

The decision to make human, or ecotoxicity reporting, or both optional reflects that the PCR committee believes that such metrics are important; however it also recognizes that there is a large degree of uncertainty surrounding toxicity and hazard assessment methods[17]. The industry will continue to monitor all available toxicity reporting methods and may make such reporting mandatory in future revisions of this PCR.

An EPD shall also include, where relevant:

- Any data on building product performance (where environmentally significant);
- Instructions and limits for efficient use;
- Organization's adherence to any environmental management system, including a statement showing where an interested party can find additional information on the system;
- Other environmental certification programs applied to the building product and a statement on where an interested party can find details of the certification program;
- Other environmental activities of the organization, such as participation in recycling or recovery programs, provided details of these programs are readily available to the purchaser or user and contact information is provided;
- Preferred waste management option for unused coating.

[17] Uncertainty of the USETox method is discussed in following publication: Ralph K. Rosenbaum, Till M. Bachmann, Lois Swirsky Gold, Mark A. J. Huijbregts, Olivier Jolliet, Ronnie Juraske, Annette Koehler, Henrik F. Larsen, Matthew MacLeod, Manuele Margni, Thomas E. McKone, Jérôme Payet, Marta Schuhmacher, Dik van de Meent, Michael Z. Hauschild *USEtox—the UNEP-SETAC toxicity model: recommended characterisation factors for human toxicity and freshwater ecotoxicity in life cycle impact assessment.* International Journal of LCA; November 2008, Volume 13, Issue 7, pp 532-546; Date: 22 Oct 2008;

10 INDEPENDENT VERIFICATION

All verification of EPD, LCA, LCI and additional environmental information shall conform to the following ISO 14025, Clause 8 provisions:

- PCR review including a review of the LCA, LCI, information modules and additional environmental information on which the PCR are based; see ISO 14025:2006, 8.1.2;
- independent verification of data from LCA, LCI and information modules, and of additional environmental information; see ISO 14025:2006, 8.1.3;
- independent verification of the EPD; see ISO 14025:2006, 8.1.4;
- the independent verifier shall generate a verification report stipulating the conclusion of the verification process, while adhering to the obligations of ISO 14025:2006, 8.3, covering rules for data confidentiality;
- this report shall be available to any person upon request;
- competence of third-party PCR review panel, according to provisions given in ISO 14025:2006, 8.2.3, and independent verifier of the EPD, according to provisions given in ISO 14025:2006, 8.2.2.

11 REFERENCES

American Coating Association – *ACA PCR for Architectural Coatings*.

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

FTC Part 260, Green Guides.[18]

Hauschild, M.Z., Huijbregts, M.A.J., Jolliet, O., Macleod, M., Margni, M.D., van de Meent, D., Rosenbaum, R.K., McKone, T.E., 2008. Building a Model Based on Scientific Consensus for Life Cycle Impact Assessment of Chemicals: The Search for Harmony and Parsimony. Environmental Science and Technology 42, 7032-7037.

USEPA, *Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI).*[19]

[18] Federal Trade Commission <http://www.ftc.gov>

[19] USEPA, Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) <http://www.epa.gov/nrmrl/std/sab/traci/>

(ILCD, 2010) Joint Research Commission, 2010, *ILCD Handbook: General Guide for Life Cycle Assessment*.[20]

Intergovernmental Panel on Climate Change (IPCC).[21]

International EPD system - *Paints and Varnishes and Related Products.*[22]

Institut Bauen und Umwelt e.V – *Requirements on the EPD for Coatings with organic binders*.[23]

ISO 14025:2006 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures.*[24]

ISO 14040:2006 *Environmental management - Life cycle assessment – Principles and framework.*[24]

ISO 14044:2006 *Environmental management - Life cycle assessment – Requirements and guidelines.*[24]

ISO 21930:2007 *Sustainability in building construction – Environmental declaration of building products.*[24]

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2008.[25]

PaintCare - http://www.paintcare.org

Rosenbaum, R.K., Bachmann, T.M., Gold, L.S., Huijbregts, M.A.J., Jolliet, O., Juraske, R., Koehler, A., Larsen, H.F., MacLeod, M., Margni, M.D., McKone, T.E., Payet, J., Schuhmacher, M., van de Meent, D., Hauschild, M.Z., 2008. USEtox - The UNEP-SETAC toxicity model: Recommended characterisation factors for human toxicity and

[20] <http://lct.jrc.ec.europa.eu>

[21] World Meteorological Organization (secretariat to IPCC), 7bis Avenue de la Paix ,C.P. 2300, CH- 1211 Geneva 2, Switzerland <http://www.ipcc.ch>

[22] http://www.environdec.com/en/PCR/Detail/?Pcr=7942

[23] http://construction-environment.com/hp6255/Product-Category-Rules-PCR.htm?ITServ=C7f00cba6X14a5367e6f7X5899

[24] International Organization for Standardization (ISO), Case postale 56, CH-1211 Geneve 20, Switzerland <www.iso.org>

[25] <http://www.epa.gov/epawaste/nonhaz/municipal/msw99.html>

freshwater ecotoxicity in life cycle impact assessment. The International Journal of Life Cycle Assessment 13, 532-546.

UFON Nano-Chemical Corporation – *Product-Category Rule for Preparing and Environmental Product Declaration for Paint*.[26]

USEPA, *Waste Reduction Model (WARM)*.[27]

USLCI Database Project, *U.S. LCI Database Project Development Guidelines*.[9]

World Business Council for Sustainable Development's Global Water Tool.[28]

World Resources Institute (WRI), *Draft Product Life Cycle Accounting and Reporting Standard.*[28]

12 GLOSSARY

Acronyms & Abbreviated Terms:

- **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 roof 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 a form of 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.

[26] <http://pcr-library.edf.org.tw/data/taiwan/ENG_EPD_PCR_Paints_final.pdf>

[27] USEPA Waste Reduction Model <http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html>

[28] WRI Product Life Cycle Accounting and Reporting Standard (second draft - English) October 2011 *Copyright © World*

- **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
- **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
- **RCMA**: Roof Coating Manufacturer's Association

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.
- **Chalking**: The formation of a friable powder on the surface caused by the disintegration of the binding medium.
- **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 capability of a building, assembly, component, product, or construction to maintain serviceability over at least a specified time. [29]
- **Fabric/Mechanical Reinforcement Layer:** an optional layer of typically polyester fabric that mechanically reinforces the coating system around its perimeter or edges. Typically, these layers are applied on 5%-10% of the entire roofing surface area.
- **Generic data:** Defined by the ILCD handbook 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."

[29] ASTM E2136 – 04 (2013), *Standard Guide for Specifying and Evaluating Performance of Single Family Attached and Detached Dwellings – Durability* <www.astm.org>

- **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.
- **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 roof coatings (e.g., pigment, solvents)
- **Resin/Binder:** Acts as the glue or adhesive to adhere the coating to the substrate.
- **Roof Coating:** A fluid-applied and fully adhered coating used for roof maintenance, roof repair, or as a component of a roof covering system or roof assembly.
- **Secondary materials**: Materials that contain recovered, reclaimed, or recycled content that is used to create basic materials for the production of roof coatings (e.g. aluminum scrap).
- **Topcoat:** The final layer of coating put onto a surface over another layer(s).
-

13 EPD FORMAT

The format of the EPD shall be as follows:

A. Front page:

1. To avoid misinterpretation of results, a company shall include a disclaimer to the audience (reader) identifying the difficulties in comparing results, and referring the reader to additional information if needed.

   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 shall 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.

2. PCR identification
3. Picture of product or family

4. Product category and subcategory
5. Manufacturer's name and contact information
6. Content of the product consistent with section 8.1
7. Information on the EPD program operator
8. Date of certification and period of validity
9. Functional unit
    i. Design life used in assessment
        1. Test methods employed for determination of design life
10. Overall data quality assessment score (poor, fair, good, or very good)
11. Site(s), manufacturer or group of manufacturers, or those representing them, for whom the results of the LCA are representative
12. Information on where explanatory material can be obtained

B. Product Definition and Characteristics

C. Key environmental parameters, as specified in *Impact Assessment Categories*, Section 7.5:
    1. Climate Change [kg CO_2-eq.]
    2. Depletion of the Stratospheric Ozone Layer [kg CFC-11 eq. / kg of emission]
    3. Acidification of Land and Water Sources [kg SO_2-eq]
    4. Eutrophication [kg N eq. / kg of emission]
    5. Formation of Smog [kg O_3 eq. / kg of emission]

D. Product specifications, as described in *Product Description*, Section 2

E. Material and energy resources, as specified in *Parameters to be Declared in the EPD*, Section 8.2, sorted by:
    1. Depletion of Non-Renewable Energy Resources (MJ)
    2. Depletion Non-Renewable Material Resources (kg)
    3. Use of Renewable Material Resources (kg)
    4. Use of Renewable Primary Energy (MJ)
    5. Consumption of Freshwater (m^3)
    6. Hazardous waste (%), and
    7. Non-hazardous waste (%)

F. Table of differentiation of use of material and energy resources (ISO 21930 8.2.6)
    1. Hydro/wind power (MJ)
    2. Fossil energy (MJ)

3. Bio-energy (MJ)
4. Nuclear- energy (MJ)
5. Other-energy (MJ);
6. Secondary fuels (MJ);
7. Non-renewable resources (kg);
8. Renewable resources (kg);
9. Recycled materials (kg);
10. Secondary raw materials (kg);
11. Water consumption (m^3);

G. Emissions and wastes,

H. Additional environmental information per *Other Environmental Information,* Section 9

I. Data Quality Assessment and disclosure and explanation of any data gaps

J. Relevant references

All results shall be reported and formatted in a way consistent with ISO 21930 guidelines.

In addition to the above, a statement as given in Figure 5 of ISO 21930 (reproduced below) shall be completed and included in the type III environmental declaration.

PCR [a] review [b], was conducted by <organization and name of the chair, and information on how to contact the chair through the programme operator>
Independent verification of the EPD and data, in accordance with ISO 21930: ☐ internal ☐ external
(Where appropriate [c]) Third-party verifier: <name of the third party verifier>
[a] Product category rules in accordance with 6.2. [b] PCR review in accordance with 9.1. [c] Optional for business-to-business communication, mandatory for business-to-consumer communication (see 5.4).

Figure 4 – ISO 21930 Example of Demonstration of Verification.

13.1 Period of Validity for the EPD

The validity of the EPD shall be reported in the EPD, and shall not exceed a five (5) year period from the date of issuance. Any changes in formulations that result in shifts in any of the environmental impact categories by more than ± 10% shall require an update to the EPD. The EPD shall be reviewed and reissued every five years from the date of issuance or earlier, as appropriate.

13.2 References

The EPD shall, if relevant, refer to:

- The underlying LCA report;
- The relevant PCR document;
- Other documents that complement, verify and support the EPD;
- Instructions for coating recycling; and
- Program Operator instructions[30].

[30] NSF Program Operator Instructions available at <http://www.nsf.org>