Product Category Rule
for Environmental Product Declarations

Architectural Coatings

NSF Sustainability℠
National Center for Sustainability Standards

Program Operator
NSF International
National Center for Sustainability Standards
Valid through June 23, 2022
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PRODUCT CATEGORY RULES EXTERNAL REVIEW PANEL

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No participation fees were 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. 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.

Table of Contents

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 AMERICAN COATINGS ASSOCIATON (ACA)

The American Coatings Association (ACA) is a voluntary, nonprofit trade association working to advance the needs of the paint and coatings industry and the professionals who work in it. The organization represents paint and coatings manufacturers, raw materials suppliers, distributors, and technical professionals. ACA serves as an advocate and ally for members on legislative, regulatory and judicial issues, and provides forums for the advancement and promotion of the industry through educational and professional development services. Information about the industry's sustainability initiatives can be seen at the following link: http://www.paint.org/about-our-industry/sustainability.html.

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. The PCR includes all life cycle phases in order to obtain the raw materials, manufacture, transport, use, and dispose of architectural coating products for interior or exterior applications. Colorants are added to the architectural coating bases at the point of sale based on the consumer's specific color preferences and are included in the scope. The definition of an architectural coating is specifically outlined in section 1.1 and generally is a coating recommended for field application to stationary structures or their appurtenances at the site of installation, to portable buildings, to pavements, or to curbs[1]. 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. This PCR is valid through June 23, 2022.

1.1 Architectural Coating Industry Classification

The coatings industry as represented by the American Coatings Association (ACA) has developed a classification scheme for architectural coatings[2]. This system is employed by the PCR to determine which products are eligible for inclusion:

- **Concrete curing, sealing, & protective coatings:** A clear or opaque coating that is formulated primarily for application to concrete and masonry surfaces.
- **General exterior coatings & interior coatings:** A coating that is not defined under any other definition in this rule and that is a decorative or protective paint or coating that is formulated for interior or exterior architectural substrates including, but not limited to: drywall, stucco, wood, metal, concrete, and masonry.

[1] Adapted from the U.S. Environmental Protection Agency's National Volatile Organic Compound Emission Standards for Architectural Coatings. 40 C.F.R. Part 59, Subpart D.
[2] These definitions were adapted from the U.S. Environmental Protection Agency's National Volatile Organic Compound Emission Standards for Architectural Coatings 40 C.F.R. Part 59, Subpart D, and the California Air Resources Board Suggested Control Measure for Architectural Coatings (Feb. 1, 2008).

- **Floor coatings:** An opaque coating that is formulated for application to flooring, including, but not limited to, decks, porches, steps, garage floors, and other horizontal surfaces which may be subject to foot traffic.
- **Primers, sealers, and undercoaters:** A coating formulated for one or more of the following purposes: to provide a firm bond between the substrate and the subsequent coatings; to prevent subsequent coatings from being absorbed by the substrate; or to prevent harm to subsequent coatings by materials in the substrate; or to provide a smooth surface for the subsequent application of coatings; or to provide a clear finish coat to seal the substrate; or to prevent materials from penetrating into or leaching out of a substrate.
- **Wood coatings:** The wood coatings category includes the following coatings: lacquers; varnishes; sanding sealers; penetrating oils; shellacs; stains; wood conditioners; and wood sealers.

Eligible products will be further classified by specific functionality in section 3.4 of the PCR. Architectural coating products must be field applied to be eligible for inclusion under this PCR.

Architectural coating products formulated with a significant amount (>5%) of post-consumer recycled content are not eligible for inclusion under this PCR, as they will be unable to consistently satisfy the performance testing requirements, functional unit, and ingredient and VOC disclosure requirements of this 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 architectural coatings industry, this PCR was designed to be applicable for the United States, but could be utilized elsewhere if desired.

The PCR Committee reviewed existing coating PCRs published by the International EPD System, UFON Nano-Chemical Corporation, and the Institut Bauen und Umwelt e.V. These PCRs for architectural coatings were found not to meet the specific scope of this PCR. This PCR improves the classification of relevant coating product categories, the functional unit of architectural coatings, and various regional assumptions. For example, existing PCRs assumed a function unit of 1kg of paint which is improper given the various performance differences between products or included products such as thinners and solvents under the same product category. This PCR also included a system to estimate the durability of architectural coatings.

The PCR Committee also utilized findings from proprietary LCAs conducted by members of the Committee to inform its assumptions.

The PCR document was prepared by NSF International (the program operator) and the American Coatings 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 architectural coatings industry personnel, material manufacturers, sustainability consultants, government agency representatives, and other experts worked to create the PCR.

The PCR at hand was formally developed by a panel of representatives of ACA and U.S. architectural coatings manufactures, and other interested parties and conforms to ISO 21930 requirements. This panel interacted with NSF International and members of the American Coatings 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 gloss levels) 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 must 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 substrate[3] for a period of 60 years (the assumed average lifetime of a building). Solid coatings shall exhibit 97% opacity after drying, whereas transparent and semi-transparent coatings need not measure opacity.

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

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

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 repaints may be needed.**

When determining opacity, ASTM D2805-11, ASTM D344-11, ASTM D5150-92(2013), or equivalent test methods shall be used.

When determining product lifespan, both design life and an averaged market-based lifetime shall be used and reported by the EPD. In order to determine a design life, the product must be classified into a low, mid, or high quality level. The specified quality level is variable and is based on the product's performance in various accepted industry durability tests. Additional information is provided in section 3.4 of the PCR.

All lifespan values in tables 1 and 2 were developed through industry consensus and are consistent with values found in publicly available literature[4].

Table 1. Market-Based Lifetime by Coating Type

Coating Type	Market-Based Lifetime
Interior Coating	5 years
Exterior Coating	10 years
Vertical Wood Stain	3 years
Horizontal Wood Stain	3 years
Concrete Stain	5 years

[4] One such example is available at http://www.nachi.org/life-expectancy.htm.

Table 2. Design Life by Coating Type and Quality Designation

Coating Type	Low Quality	Mid Quality	High Quality
Interior Coating	3 years	7 years	15 years
Exterior Coating	5 years	10 years	20 years
Vertical Wood Stain	3 years	7 years	15 years
Horizontal Wood Stain	1 year	3 years	5 years
Concrete Stain	5 years	10 years	20 years

If no eligible durability tests have been conducted, the product shall use the low quality design life for the purposes of the EPD. With the exception of interior coatings, if the product offers a warranty covering the performance of the coating, then the specific warranty period may be used as the design life in lieu of the values in table 2.

Primer coatings should only utilize the market-based lifetimes, as their role does not merit the types of performance testing outlined in section 3.4., since they are formulated to promote adhesion of a topcoat and not to be applied by themselves. As such, interior primers shall be assumed to have a lifetime of 5 years and an exterior primer to have a lifetime of 10 years. Reporting impacts using a technical life for primer coatings is unnecessary, and optional.

If necessary, a standardized amount of colorant shall be added to the architectural coating depending on what type of base the product represents (for example, a light base, mid base, ultra deep base, etc.). A specific colorant LCI has been chosen in section 3.5.1 as a “worst case” example for inclusion in the LCA results of the architectural coating base in order to provide an estimate of the overall impact value for the coating. This was determined to be

the optimal approach for disclosure purposes given the infinite possibilities of colorant/base combinations. See section 3.5 for additional details.

3.4 Sub category descriptions

The EPD shall provide information for the entire product. The product or range of products shall denote which subcategory of architectural coatings function that the unit represents. Each subcategory has a list of tests used to classify the product as a low, mid, or high quality product. These tests can be administered either internally by the reporting company or by a third-party. ***A product must meet the thresholds of all the tests in its subcategory to qualify for a given quality level.*** For example, to be classified as a high quality interior architectural coating the product would need to last for more than 400 scrubs, show a gloss change of less than 10, ***and*** have an average washability score of over 7, according to ASTM's scale. ***If the product performs at different quality levels in the durability tests, then it should be classified using its lowest performance category.*** Therefore, if an interior coating meets the high quality thresholds for burnishing and washability but only the mid quality threshold for scrubs, then it should be classified using the mid quality design lifetime.

3.4.1 Interior Architectural Coatings: Interior architectural coatings shall be defined as a coating that meets the product category requirements in section 1.1 of the PCR that is applied to substrates that primarily reside in interior environments with the exception of stains. Products that are not designed to entirely hide a substrate (such as clear coatings), shall still satisfy the functional unit with the exception of the opacity criterion, which shall be excluded.

The consensus-based ASTM methods shown below are industry-recognized and approved test methodologies for demonstrating the durability of an interior architectural coating in the United States. Similar consensus-based methods (such as ISO or EN) can be substituted as long as the methodology is comparable and its results can be statistically correlated to the corresponding framework used by ASTM. These tests can be administered either internally by the reporting company or by a third-party. Durability assessment schemes created without using a consensus-based framework are not allowable for use in the EPD. The testing schemes utilized must be disclosed in the EPD; however the specific test results need not be reported.

Table 3. Interior Design Life Thresholds

Test Type	Test	Substrate	Low Quality Design Life Threshold	Mid Quality Design Life Threshold	High Quality Design Life Threshold
Scrub Resistance	ASTM D2486 - 06(2012)e1	Plastic	<100 Scrubs	Between 100-400 Scrubs	>400 Scrubs
Burnish - 20 Cycle	ASTM D6736 - 08(2013)	Plastic	Change in Gloss ≥20	Change in Gloss between 10-20	Change in Gloss <10
Washability[5]	ASTM D4828 - 94(2012)e1	Plastic	Average Score <3	Average Score between 3-7	Average Score >7

If the product has not undergone all of these or other eligible durability tests, then the low quality design life estimate shall be used. Warranties shall not be used as a substitute for design life for interior coatings.

3.4.2 Exterior Architectural Coatings: Exterior architectural coatings shall be defined as a coating that meets the product category requirements in section 1.1 of the PCR that is applied to substrates that primarily reside in exterior environments with the exception of stains. Products that are not designed to entirely hide a substrate (such as clear coatings), shall still satisfy the functional unit with the exception of the opacity criterion which shall be excluded.

The consensus-based ASTM methods shown below are industry-recognized and approved test methodologies for demonstrating the durability of an exterior architectural coating in the United States. Similar consensus-based methods (such as ISO or EN) can be substituted as long as the methodology is comparable and its results can be statistically correlated to the corresponding framework used by ASTM. These tests can be administered either internally by the reporting company or by a third-party. Durability assessment schemes created without using a consensus-based framework are not allowable for use in the EPD. The testing schemes utilized must be disclosed in the EPD; however the specific test results shall not be reported.

[5] Test shall be run in triplicate, taking an average of each individual stain or interior coating. The cleaning solution shall be a solution of 0.5% nonyl phenoxy ethanol, non-ionic detergent, and 0.25% Tri Sodium Phosphate in distilled water. The soilants (stains) shall be coffee, wine, mustard, pencil, and leneta ST-1.

Table 4. Exterior Design Life Thresholds

Test Type[6]	Test	Substrate	Low Quality Design Life Threshold	Mid Quality Design Life Threshold	High Quality Design Life Threshold
Blistering	ASTM D714-02(2007)	Southern Yellow Pine	Blistering present after 12 months exposure.	No blistering present after 12 months exposure.	No blistering present after 18 months exposure.
Erosion	ASTM D662-93(2011)	Southern Yellow Pine	Erosion present after 12 months exposure.	No erosion present after 12 months exposure.	No erosion present after 18 months exposure.
Flaking/Peeling	ASTM D772-86(2011)	Southern Yellow Pine	Flaking and peeling present after 12 months exposure.	No flaking and peeling present after 12 months exposure.	No flaking and peeling present after 18 months exposure.
Biologic Growth	ASTM D3274-95 or -09(2013)	Southern Yellow Pine	Biologic growth present after 9 months exposure.	No biologic growth present after 9 months exposure.	No biologic growth present after 12 months exposure.

If the product has not undergone all of these or other eligible durability tests, then the low quality design life estimate shall be used. If the product offers a warranty covering the performance of the coating, then the specific warranty period may be used as the design life in lieu of the generic values in table 2.

3.4.3 Stains: Architectural stains shall be defined as a coating that meets the product category requirements in section 1.1 of the PCR and is a semitransparent, transparent, or opaque coating formulated to change the color of a surface but not typically to conceal the grain pattern or texture. Stains shall still satisfy the functional unit with the exception of the opacity criterion which shall be excluded.

The consensus-based ASTM methods shown below are industry-recognized and approved test methodologies for demonstrating the durability of stains in the United States. Similar consensus-based methods (such as ISO or EN) can be substituted as long as the methodology is comparable and its results can be statistically correlated to the corresponding framework used by ASTM. These tests can be administered either internally by the reporting company or by a third-party. Durability assessment schemes created without using a consensus-based framework are not allowable for use in the EPD. The testing schemes utilized must be disclosed in the EPD; however the specific test results shall not be reported.

[6] Test should be conducted consistent with ASTM D1006/D1006M-13 or equivalent methods.

Table 5. Stain Design Life Thresholds

Test Type[7]	Test	Substrate	Low Quality Design Life Threshold	Mid Quality Design Life Threshold	High Quality Design Life Threshold
Blistering	ASTM D714-02(2007)	Southern Yellow Pine	Blistering present after 3 months exposure.	Blistering present after 6 months exposure.	No blistering present after 6 months exposure.
Erosion	ASTM D662-93(2011)	Southern Yellow Pine	Erosion present after 3 months exposure.	Erosion present after 6 months exposure.	No erosion present after 6 months exposure.
Biologic Growth	ASTM D3274-95 or -09(2013)	Southern Yellow Pine	Biologic growth present after 3 months exposure.	Biologic growth present after 6 months exposure.	No Biologic growth present after 6 months exposure.

If the product has not undergone all of these or other eligible durability tests, then the low quality design life estimate shall be used. If the product offers a warranty covering the performance of the coating, then the specific warranty period may be used as the design life in lieu of the generic values in table 2.

3.5 Colorants

Oftentimes the finished coating leaving the manufacturing facility is not the same as the coating that gets applied by the purchaser. This is because a small amount of colorant is added at either the point of sale or point of application by the purchaser to make the coating a desired color. Because there are infinite color possibilities, the PCR committee decided to model a worst-case colorant scenario to provide a conservative estimate of this impact. As such, the scenario described below estimates larger amounts of a 'high-impact' colorant being used than would typically occur in real-world cases. However, given the small amount of colorant needed to tint a coating, its overall environmental impact is still expected to be small.

An amount of a predefined colorant defined in section 3.5.1 shall be added to the EPD results depending on the type of base the architectural coating represents. All coatings that can accept a colorant must assume one is added in the appropriate quantity.

The table below shows how much colorant is assumed to be added per gallon of each base type. This value shall then be translated into the proper amount to satisfy the quantity of base coating needed to satisfy the functional unit

[7] Test should be done consistent with ASTM D1006/D1006M-13 or equivalent methods.

and shall be disclosed in the EPD (see section 13 for more details). For example, if the coating is classified as a light base, it would require 31ml of colorant per liter as shown in Table 6. If a liter of the base coating weighed 2kg and 100g are needed to satisfy the function unit, 1.55ml (or 31ml/(2000g/100g)) of colorant would be needed to satisfy the functional unit.

Table 6. Colorant Amounts per Base Type

Base Type	Amount of Colorant Needed per Liter of Coating
Tintable White	23 ml
Light Base	31 ml
Pastel Base	46 ml
Mid Base	62 ml
Deep Base	78 ml
Accent Base	93 ml
Ultra Deep Base	109 ml
Neutral Base	125 ml

3.5.1 Colorant Impacts

Because there are few Life Cycle Inventories that are widely accessible for colorants, the GaBi Carbon Black (furnace black; deep black pigment – Revised 11/30/2014) aggregated LCI shall be used in all EPDs that require a colorant. This aggregated LCI was determined by the PCR Committee to be the most appropriate representation

of Carbon Black. Using the same LCI ensures a consistent and credible impact value across the coatings industry for this portion of the life-cycle which is outside of the immediate control of manufacturers.

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, energy, and environmental relevance for the system shall be captured.

For materials characterized as hazardous and/or toxic 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 at a minimum be consistent with ISO 21930 6.2.5. EPDs shall include all life cycle phases, from cradle-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 ACA 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 paint roller or spray applicator could be used to paint 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 architectural 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 1 illustrates which processes are relevant for completion of the EPD.

Life Cycle Stages

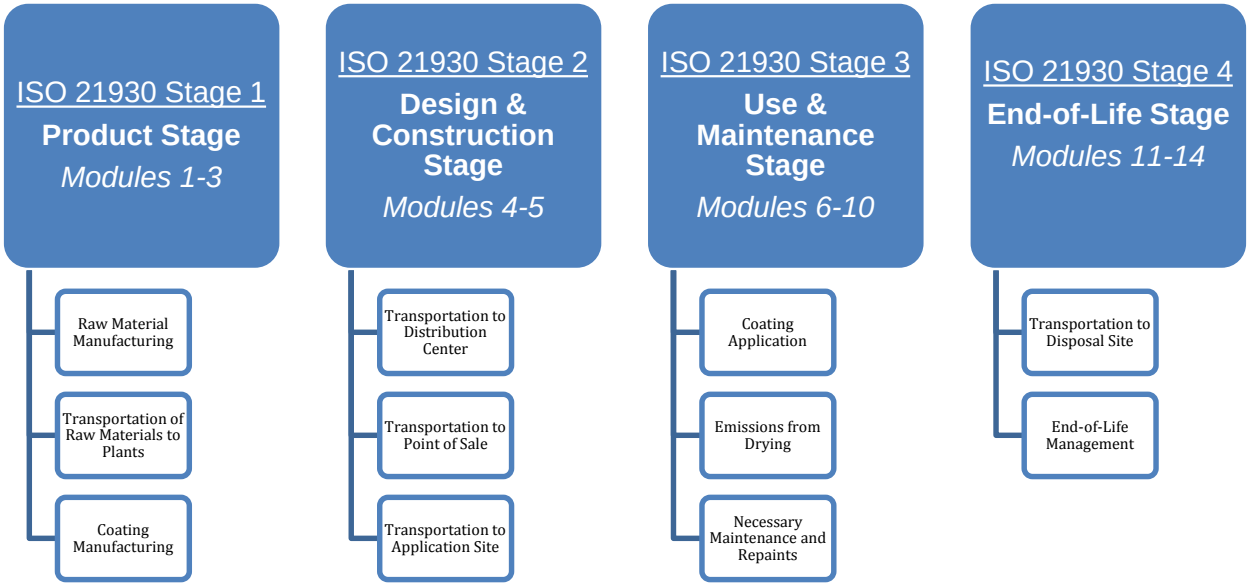

Figure 1 — Relevant system boundaries, information modules and life-cycle stages of building products

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 coatings product and packaged for shipping. During production, the product undergoes the transformation from intermediate materials to the final coatings product; additionally, any co-products or wastes formed during production shall be accounted for in this stage. Processing typically includes measured amounts of

ingredients being placed 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.

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 architectural 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 architectural 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;
  - Use of catalysts or other ancillary materials during production;
  - Primary packaging of the final product shall be included.

Inbound transportation shall be included in the life cycle inventory for the processing stage. All transportation, including interfacility 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 and/or modes.

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 this stage 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)[28]. 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[8]

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	32 Base metal in prim. or semifin. 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 architectural coating, e.g., storage at a distribution center and a retail location. Product distribution

[8] 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.

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 and/or facilities.

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

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[9]. For many architectural coatings, the application does not require energy or generate smog-forming emissions (e.g., no-VOC paints); for these products, maintenance and repaints may be the only major processes.

For architectural 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 paint or 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). Content emitted due to drying/curing shall be subtracted from the total coating mass that remains on the wall, which is assumed to be disposed at end of life. For example, if 1kg of coating is needed to satisfy the functional unit, but 500g of the content is emitted from the film due to curing/drying, then only 500g of coating would remain on the substrate to be transported and disposed during the end-of-life.

Typical processes to be included for the use stage are:

- Normal application (including drying/curing); and
- Necessary repaints and maintenance occurring during the usage time of 60 years.

As mentioned in section 3.3, multiple coats and/or repaints may be needed to satisfy the functional unit.

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 paint/coating, other unused paint/coating, and primary packaging;

[9] 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.

- Incineration; and
- Landfilling, landfill maintenance, decomposition emissions.

Based on data from the industry's PaintCare® program, it shall be assumed that waste coatings travel 7 miles 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[10]. Energy generated from incineration shall be credited using the Avoided Burden Method[11] 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 painted-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.

The coatings industry has a program in place (PaintCare®) for the recycling of post-consumer coatings to be re-processed back into paint. Currently, the PaintCare program has been adopted by 8 states and is active in 5 states. At this time, not enough data is available to incorporate such a take-back program into the PCR, but in future revisions this end-of-life option may be available for use in EPDs.

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[26]) 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,

[10] See http://www.paintcare.org/wp-content/uploads/docs/ca-annual-report-2014.pdf.
[11] 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

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[12].

See Figure 2 below for additional information for modeling recycling processes.

[12] 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'.

Figure 2 illustrates a simplified process map for a product that uses the Avoided Burden Method as it relates to coating manufacturing.

Avoided Burden Process Map

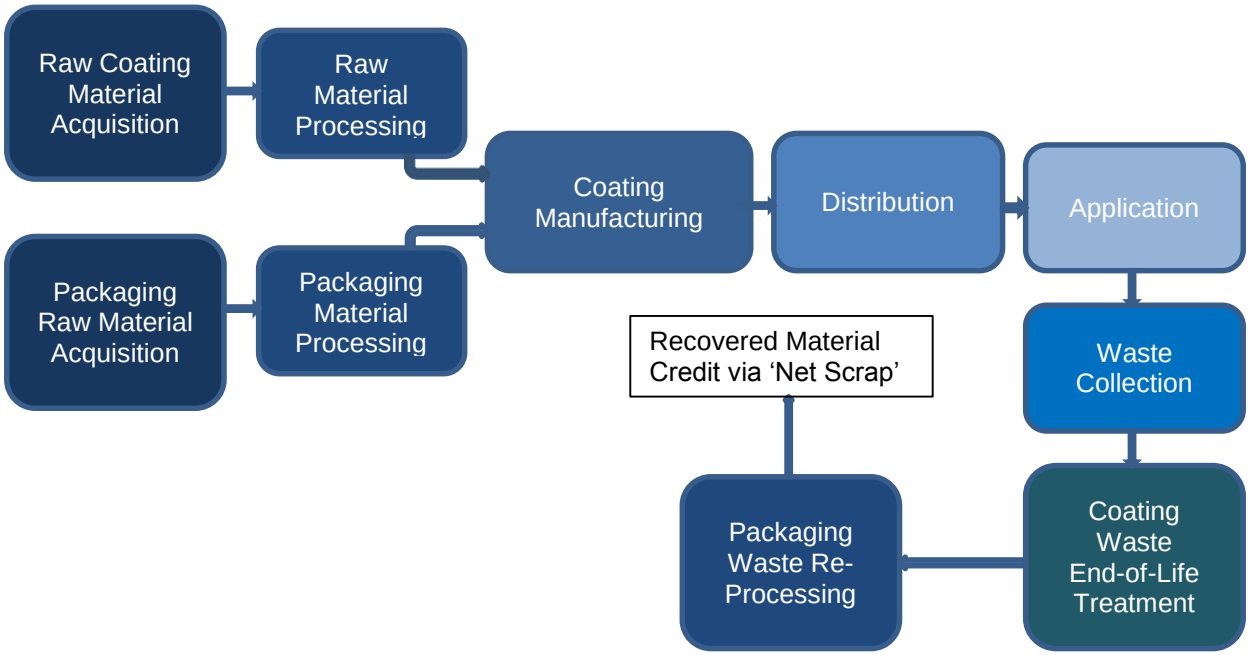

Figure 2 - Process Map Illustrating Avoided Burden Approach to Recycling

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).

5. Suitable data quality assessment frameworks include (but are not limited to):
    a) USLCI Data Guidelines[13]
    b) ILCD Handbook[14]
    c) Table 8.2: Criteria to Evaluate the Data Quality Indicators, WRI product standard[15]

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 and/or intermediates in the pigment and binder(s) manufacturing processes must 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 must 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 can be used as long as the implications are properly reflected in the data quality assessment following section 7.2.

Carbon offsets or Renewable Energy Credits or Certificates shall not be accounted for in the inventory. These refer

[13] http://www.nrel.gov/lci/docs/dataguidelinesfinalrpt1-13-04.doc
[14] 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=y8dIS7GUWMdSR0EAlMEUUsWb0000YvMK-6Wt;sid=02ZBuqZp_GlBrvSwWXTfHcRMcaU96qG61bU=?FileName=LBNA24708ENC_002.pdf&SKU=LBNA24708ENC_PDF&CatalogueNumber=LB-NA-24708-EN-C
[15] http://www.wri.org/sites/default/files/pdf/ghgp_product_life_cycle_standard.pdf

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 on its overall impact over the lifetime of a building, the PCR requires LCA results to be calculated and disclosed for both an average market-based lifetime and the design life. As such, no additional sensitivity analyses are required for the creation of the EPD, but can be conducted and included if indicated.

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.

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. 1) 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[16] (m^3)

Renewable energy sources are defined as renewable nonfossil 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.

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

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[17] (kg) or
2. Non-hazardous waste (kg)

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. 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.

[17] As defined by RCRA under 40 CFR 261.33

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 report toxicity related to human health, the environment, or both using the USEtox method. Toxicity 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 toxicity reporting 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[18]. 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

[18] 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;

provided;

- Preferred waste management option for leftover paint or coating.

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

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Intergovernmental Panel on Climate Change (IPCC).[22]

International EPD system - *Paints and Varnishes and Related Products.*[23]

Institut Bauen und Umwelt e.V – *Requirements on the EPD for Coatings with organic binders*.[24]

ISO 14025:2006 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures.*[25]

ISO 14040:2006 *Environmental management - Life cycle assessment – Principles and framework.*[25]

[19] Federal Trade Commission <http://www.ftc.gov>
[20] USEPA, Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) <http://www.epa.gov/nrmrl/std/sab/traci/>
[21] <http://lct.jrc.ec.europa.eu>
[22] World Meteorological Organization (secretariat to IPCC), 7bis Avenue de la Paix ,C.P. 2300, CH- 1211 Geneva 2, Switzerland <http://www.ipcc.ch>
[23] http://www.environdec.com/en/PCR/Detail/?Pcr=7942
[24] http://construction-environment.com/hp6255/Product-Category-Rules-PCR.htm?ITServ=C7f00cba6X14a5367e6f7X5899
[25] International Organization for Standardization (ISO), Case postale 56, CH-1211 Geneve 20, Switzerland <www.iso.org>

ISO 14044:2006 *Environmental management - Life cycle assessment – Requirements and guidelines.*[25]

ISO 21930:2007 *Sustainability in building construction – Environmental declaration of building products.*[25]

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

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[26] <http://www.epa.gov/epawaste/nonhaz/municipal/msw99.htm>
[27] http://pcr-library.edf.org.tw/data/taiwan/ENG_EPD_PCR_Paints_final.pdf
[28] USEPA Waste Reduction Model <http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html>
[29] WRI Product Life Cycle Accounting and Reporting Standard (second draft - English) October 2011 *Copyright © World*

12 GLOSSARY

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 PE INTERNATIONAL GaBi Databases are LCA databases that contain ready-to-use Life Cycle Inventory profiles.
- **LCA**: Life Cycle Assessment or Analysis. A technique to assess environmental impacts associated with all the stages of a product's life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling), 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

Terminology:

- **Architectural coating:** A coating recommended for field application to stationary structures or their appurtenances at the site of installation, to portable buildings, to pavements, or to curbs. For purposes of this PCR an 'architectural coating' does not include adhesives and coatings for shop applications or original

equipment manufacturing, nor does it include coatings solely for application to non-stationary structures, such as airplanes, ships, boats, and railcars*. Please see the product category requirements in Section 1.1 of the PCR for additional clarification.*

- **Biologic growth or bio deterioration:** Any undesirable change in material properties brought about by the activities of microorganisms.
- **Blistering**: The formation of dome shaped hollow projections in paints or varnish films resulting from the local loss of adhesion and lifting of the film from the surface or coating.
- **Burnish resistance**: The resistance of a coating to an increase in gloss or sheen due to polishing or rubbing.
- **Design life**: The estimated lifetime of a coating based solely on its hiding and performance characteristics determined by results in certain ASTM durability tests.
- **Durability**: The degree to which coatings can withstand the destructive effect of the conditions to which they are subjected and how long they retain an acceptable appearance and continue to protect the substrate.
- **Erosion:** The wearing away of the top coating of a painted surface e.g., by chalking, or by the abrasive action of windborne particles of grit, which may result in exposure of the underlying surface. The degree of resistance is dependent on the amount of coating retained.
- **Flaking/Peeling**: The phenomenon manifested in paint films by the actual detachment of pieces of the film itself either from its substrate or from paint previously applied. Peeling can be considered as an aggravated form of flaking. It is frequently due to the collection of moisture beneath the film.
- **Gloss:** A value of specular reflection which is often used to categorize certain types of paints.
- **Intermediate processing**: the conversion of raw materials to intermediates (e.g. titanium dioxide ore into titanium dioxide pigment, etc.).
- **Market-based life:** The estimated lifetime of a coating based off the actual use pattern of the product type.
- **Pigment:** The material(s) that give a coating its color.
- **Primary materials**: Resources extracted from nature. Examples include titanium dioxide ore, crude oil, etc. that are used to create basic materials used in the production of architectural coatings (e.g., titanium dioxide).
- **Resin/Binder:** Acts as the glue or adhesive to adhere the coating to the substrate.
- **Scrub:** To wipe one time typically with an abrasive material.

- **Scrubbability or scrub resistance:** The ability of a coating to resist being worn away or to maintain its original appearance when rubbed repetitively with an abrasive material.
- **Secondary materials**: Recovered, reclaimed, or recycled content that is used to create basic materials to be used in the production of architectural coatings.
- **Washability:** The ease with which the dirt can be removed from a paint surface by washing; also refers to the ability of the coating to withstand washing without removal or substantial damage.

13 EPD FORMAT

The format of the EPD should be 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, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per ISO 21930 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis.

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. Market-based life used in assessment
   ii. Design life used in assessment
      1. Test methods employed for determination of design life
   iii. Amount of colorant needed
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 (%) or
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 (m^3)

G. Emissions and wastes,

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

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

J. Relevant references

All results must 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 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 program operator>

Independent verification of the EPD and data, in accordance with ISO 21930: internal vs. 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).

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%, excluding colorants added at point of sale, 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/newsroom_pdf/NSF_Program_Operator_Instructions-news.pdf