Product Category Rule
for Environmental Product Declarations

PCR for Resinous Floor Coatings v1 – 2026 Extension

Program Operator
NSF International
National Center for Sustainability Standards
Extended 8 months per PCRExt 2026-103, valid through August 5, 2026
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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 were 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

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This PCR is being revised; when published, the latest version of the PCR supersedes this extension.

The following changes have been included in this document:

- Extended 8 months per PCRExt 2026-103

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ABOUT NSF'S NATIONAL CENTER FOR SUSTAINABILITY STANDARDS (NCSS)

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

The National Center for Sustainability Standards 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 LCA, receive your 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 14025:2006 and ISO 21930:2017. The PCR includes all life cycle phases in order to obtain the raw materials, manufacture, transport, use, and disposal of resinous floor coating products for interior applications. The definition of a resinous floor coating is specifically outlined in Section 1.1 and generally is a coating for field application that is poured and/or formed in place to protect and enhance horizontal substrates such as concrete, metal, and wood. Some resinous floor coatings may be thermoset products. The scope excludes carpeting, planks, veneers, tile and sheet goods, dedicated flooring systems, and coatings that are not field applied. Finally, this PCR does not include coatings that fall under the American Coating's Associations PCR for Architectural Coatings including wood stains.

1.1 Resinous floor coating industry classification

The resinous floor coatings industry, as represented by the American Coatings Association (ACA), has developed a definition for resinous floor coatings. For the purposes of this PCR, a resinous floor coating is defined as "a fluid-applied and poured / formed in place and cured material coating used to protect and enhance horizontal substrates such as concrete, metal, and wood from foot traffic". Resinous floor coatings can be further classified by the subcategories below:

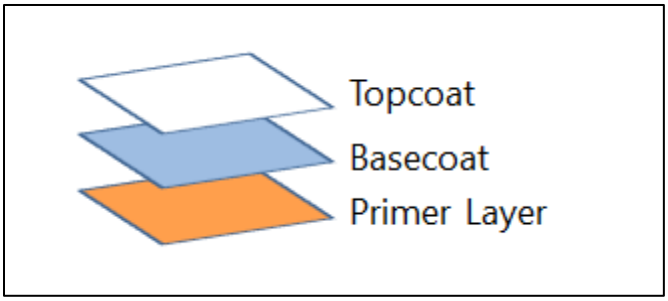
— **thin-mil**: A resin rich coating system typically comprised of a primer, body coat(s), and topcoat installed less than 40 mils.

— **self-leveling or broadcast slurries**: A high build coating system using the addition of fillers and/or, broadcast aggregates (quartz, flake silica sand) installed in multiple layers to build thickness typically from 40 to 180 mils.

— **mortars, monolithic mortars, and terrazzo**: A composite material consisting of marble, silica sand, granite, glass or other suitable aggregate in a binder matrix of Portland cement mortar, epoxy resin, polyester resin, or vinyl ester resin. Typically installed to build thickness greater than 180 mils.

Resinous floor coatings shall be assessed as a product system as opposed to individual coatings or layers. For example, epoxy floor coatings are typically made up of at least a basecoat and a topcoat. 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 resinous floor coating system as shown below in Figure 1.



NOTE — It is possible for a resinous floor coating system to require a different number and/or types of layers than what is represented above.

Figure 1

Example of a resinous Floor coating system with 3 layers

Non-coating flooring products are **not eligible** for inclusion under this PCR.

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

Given wide formulation ranges, optional coating layers, performance difference, and chemical precursor variability, industry average or average EPDs for a specific product line shall not be developed using this reference PCR. Instead, each product within a product line assessed in the EPD shall be reported on an individual basis. This decision was reached by the PCR Committee because any average or industry average EPDs wouldn't reflect an actual product and the environmental impact category range in ISO 21930:2017 (< 10%) would not be feasible given the diverse nature of resinous floor coating products.

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 American Coatings Association,[1] UL Environment,[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 resinous floor coating product categories, the functional unit of resinous floor coatings, and various regional assumptions. For example, existing PCRs assumed a functional unit of 1kg which is improper given the various performance differences between products or included products such as carpeting and vinyl planks under the same product category. The PCR Committee used the American Coating Association's PCR for Architectural Coatings as a foundation for this PCR as it included certain types of coatings that could potentially be used in residential flooring scenarios (notably stains), but modified assumptions surrounding functional unit, application, performance, and composition to be specifically relevant for resinous floor 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 Resinous Floor Coatings PCR. It is worth noting that the same approach was successfully completed by the Roof Coating Manufacturer's Association PCR, which was published in 2016.

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 resinous floor coatings, strong similarities do exist between these LCAs/EPDs and the manufacturing, composition, and application of certain floor coating types. For example, epoxy floor coatings are chemically similar to epoxy paints. As such, these were a crucial resource and helped inform key assumptions and identify hotspots.

The PCR document was prepared by NSF International (the program operator) and the American Coatings Association Product Category Work Group in accordance with ISO 14025:2006. An open enrollment period was provided to seek out stakeholders interested in being part of the PCR creation. A multi-stakeholder group composed of coatings industry personnel, material manufacturers, regulators, and other experts worked to create the PCR.

The PCR at hand was formally developed by a panel of representatives of ACA members and US coatings manufacturers, raw material suppliers, standards development groups, regulators, and other interested parties and conforms to ISO 21930:2017 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

[1] Available at https://standards.nsf.org/apps/group_public/download.php/28098/ACA%20PCR%20%2006-17-15%20-%20Final.pdf

[2] Available at https://industries.ul.com/wp-content/uploads/sites/2/2014/09/UL-Environment-PCR-Addendum-for-coatings-with-organic-binders.pdf

[3] Available at https://epd-online.com/Pcr/PdfDownload/5309

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 system, product manufacturer, product model number, a general description (including all components and layers), and a picture of the packaged product. 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. If the product system is not conventionally packaged for sale in a retail store, a related image such as one of the final, cured product in a building setting may be used instead.

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 21930:2017 and 14025:2006, based on an ISO 14040:2006 and ISO 14044:2006 conformant LCA study. This declaration shall solely be used in a Business to Business (B2B) capacity.

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 construction and be conformant with ISO 21930:2017, Clause 5.5.

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

- functional unit (Section 3.2);
- criteria for inclusion of inputs and outputs (cut-off rules) (Section 3.6);
- system boundaries (Section 4);
- description of data (Sections 4.1 through 4.4);
- units and quantities (Section 6); and
- data quality requirements (Section 7).

3.2 Functional unit

The functional unit shall be 1 m^2 of covered and protected flooring surface[4] for a period of 60 years (the expected lifetime of the building). Resinous floor coatings shall exhibit an appropriate thickness (based on its technology type and defined by the manufacturer's published application guidelines) and desired performance attributes after curing. The system also shall include any grit, aggregate, etc. needed between product layers or within the topcoat if required to achieve expected product performance and/or recommended by the manufacturer.

This PCR applies to resinous floor 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 selected lifetime of a coating does not cleanly divide into the functional unit (e.g., a coating lasts 25 years), repaints shall be rounded up to the nearest two decimal places. As such, a coating that lasts 25 years would require 1 original coat and 2.40 repaints, for a total of 3.40 applications to satisfy the 60-year lifespan of the functional unit. It is also common for resinous floor 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.**

When determining product lifespan, both the market service lifetime and technical service lifetime shall be used in the calculations and reported in the EPD. This approach was also utilized in the ACA Architectural Coating PCR, as there will be cases where customers replace the resinous floor coating before it has technically failed. By

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

reporting both types of service lifetimes in the EPDs, it allows end-users to pick the scenario best suited to their needs. Both types of service lifetime are defined in the glossary.

In order to determine the proper market and technical lifetimes, the product must be classified by if it is a thin-mil, self-leveling or broadcast slurry, or mortar / monolithic mortar / terrazzo. Expected lifetimes are based on industry consensus given different application settings (commercial or industrial). Additional information is provided below.

All lifespan values in Tables 3.1 and 3.2 were developed through industry consensus and are consistent with values found in publicly available literature and manufacturer claims.

Table 3.1
Service life by coating type – Product designed for commercial application

Coating types	Estimated market service life	Estimated technical service life
thin mil floor coatings	10 years	15 years
self-leveling or broadcast slurry floor coating	20 years	30 years
mortar / monolithic mortar / terrazzo floor coatings	30 years	60 years

Table 3.2
Service life by coating type – Product designed for industrial application

Coating types	Estimated market service life	Estimated technical service life
thin mil floor coatings	5 years	5 years
self-leveling or broadcast slurry floor coating	10 years	15 years
mortar / monolithic mortar / terrazzo floor coatings	20 years	30 years

The EPD shall provide information for the entire coating system. The product or range of products shall denote which service lifetimes of resinous floor coating function that the unit represents.

Resinous floor coatings designed specifically for industrial settings rather than commercial environments shall use the estimated service lifetimes listed above in Table 3.2 rather than those in Table 3.1. If the product type is applied indiscriminately between industrial and commercial settings, it shall default to the industrial service lifetime values in order to be conservative or the EPD may report impacts using both the commercial and industrial scenarios.

The thickness ranges shown below in Table 3.3 represent general guidelines and EPDs may use thicknesses different than those in the ranges specified above. The thicknesses used in the EPD shall reflect what is reported in the Product Data Sheet or Technical Data Sheet for the relevant product system.

Table 3.3
General coating thickness guidelines by resinous floor coating type

Coating types	Estimated technical service life
Thin mil floor coatings	< 40 mils
Self-leveling or broadcast slurry floor coating	40 to 180 mils
Mortar / monolithic mortar / terrazzo floor coatings	> 180 mils

3.4 Colorants

Resinous floor coatings are not typically formulated to be tinted at point-of-sale or in the field. 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 resinous floor coatings. However, there may be some unusual cases where a product may be tinted either at the point-of-sale or in the field. If this is expected to occur for a specific product, it shall assume that 6 oz of the LCI Carbon Black (furnace black; deep black pigment – revised 11/30/2014) from thinkstep be used in each gallon of product. This aggregated inventory was selected as a

worst-case colorant for the purposes of the American Coating Association PCR and ensures a consistent and credible impact value across the industry for the portion of the life-cycle which is unusual for this product type as well as outside the immediate control of manufacturers. This inventory is available from the American Coatings Association.

3.5 Cut-off rules

Cut-off rules shall be as described in ISO 21930:2017 clause 7.1.8. The cut-off criteria shall be 1% of renewable primary resource (energy), 1% nonrenewable primary resource (energy) usage, 1% of the total mass input of that unit process and 1% of environmental impacts. The total of neglected input flows per module shall be a maximum of 5% of energy usage, mass and environmental impacts.

For materials characterized as hazardous by the Globally Harmonized System (GHS),[5] cut-off rules do not apply and such substances shall be included in the inventory.

3.6 Treatment of biogenic carbon

Although uncommon for resinous floor coatings, there may be cases where bio-based materials are used in a resinous floor coating system. Any mass flows of biogenic carbon shall be reported specifically as biogenic carbon (reported in terms of CO_2 in the LCI) and shall be accounted in the module during which any sequestration or emission action occurs.

Any delayed emissions from a temporary carbon sequestration (through a biopolymer that eventually degrades, for example) shall follow the rules in ISO 21930:2017 Section 7.2.9. and this information only reported under "Additional Environmental Information."

As stated in ISO 21930:2017 Section 7.2.8., carbonation shall be considered throughout the life-cycle. However, this will rarely be relevant in resinous floor coatings products and should be assessed only when relevant. Similarly, Greenhouse gas emissions from land-use changes shall be considered only when significant per ISO 21930:2017 Section 7.2.11.

If relevant to the product system (and information is available), the indicators below regarding the uptake and

[5] See https://www.osha.gov/dsg/hazcom/global.html for additional information.

emissions of CO_2 **shall** be separately reported if they are considered in the quantification of the global warming potential to conform with ISO 21930:2017 7.2.12. This serves to enhance transparency regarding possible contributions to global warming potential throughout the product system.

— biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within bio-based products, occurring in each module;

— biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within the bio-based packaging, occurring in each module;

— CO_2 from calcination and carbonation, reporting the emissions and uptake of CO2 from calcination and carbonation occurring in the relevant modules;

— biogenic CO_2, reporting the emissions from combustion of waste from renewable sources used in product processes; and

— CO_2 emissions from combustion of waste from non-renewable sources used in product processes.

3.7 Rules for averaging data

Instances will likely occur where products are made at multiple manufacturing locations or travel to different distribution or retail centers. For situations such as this, a weighed average of production volume at each facility and/or site shall be utilized for calculation purposes.

For example, if Site A manufactures 80% of the product system covered by the EPD and each kilogram of product manufactured requires 5 MJ of energy whereas as Site B makes 20% of the product and each kilogram of product manufactured requires 10 MJ of energy, the average energy used per kilogram would be 6 MJ ((80%*5)+(20%*10)).

The same logic would apply for transportation distances.

If information is unavailable and default values are not already provided by this PCR, justification for any used values shall be documented and disclosed in both the project report and subsequent EPD.

3.8 Comparability

Per ISO 21930:2017, comparability of product systems using this reference PCR shall only be done in the context of construction works and shall meet all requirements listed in Section 5.5.

Additionally, comparative assertions (i.e., superiority claims vs. a competing product) regarding the specific product system shall not be made in the EPD and any comparison must also consider both the limitations of LCA as only potential impacts are being reported by the EPD (damage is not being assessed). All EPDs must contain the statement on the limitations of the study described in Section 13 of this reference PCR.

4 SYSTEM BOUNDARIES

The system boundary of EPDs shall at a minimum be consistent with ISO 21930:2017 Section 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 LCAs conducted by ACA member companies to represent a negligible environmental impact in the overall life-cycle performance of a coating. These studies are not publicly available as they are company-specific and contain confidential data, but the general findings and assumptions were discussed and accepted by the PCR Committee. 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 coat 1,000 m^2 of substrate or 10 m^2 given differing job sizes, products selected, applicator type, substrate, etc. As such, there is no reliable way to

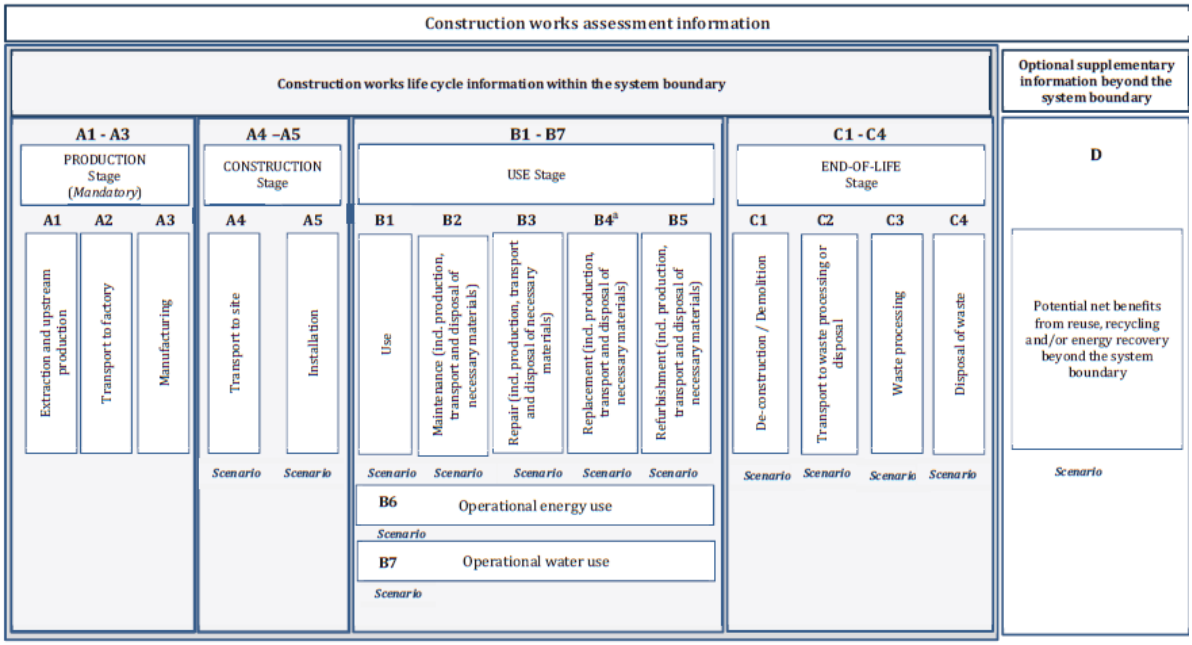
account for this impact in terms of the functional unit. However, screening LCAs conducted by coatings manufacturers estimate that this impact is minimal relative to the overall lifecycle impacts of coatings and would not significantly impact EPD results. For these reasons, the PCR committee excluded 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.

As stipulated by ISO 21930:2017, the system boundary shall follow both the modularity and polluter pays principle. These are discussed in greater detail in ISO 21930:2017 in Section 7.1.1 and Table 3.1.

The figure below illustrates which processes are relevant for completion of the EPD.



[a] Replacement information module (B4) not applicable at the product level.

Figure 2

Relevant system boundaries, information modules and life-cycle stages of building products – Figure 2, pg. 26 ISO 21930:2017

4.1 Stages A1-A3 – Production stage

The material acquisition, pre-processing, intermediate processing, and processing stage (production 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 resinous floor coating technology. For example, urethane 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 resinous floor 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 resinous floor 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.); and

- 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; and

  - primary packaging of the final product.

Inbound transportation shall be included in the life cycle inventory for the Production Stage. All transportation, including inter-facility transport, prior to the material being shipped to the application site 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 in this stage. 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 32 km. 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 [US EPA 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 the most current version of the US EPA Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures. Outside of the US, regionally or nationally appropriate recycling rates shall be used.

Table 7
North American Default Material Transport Distances from 2007 US DOT Shipment Characteristics by Standard Classification of Transported Goods (SCTG) Commodity Code

Raw material / classification grouping		Distance (kilometers)		
		Rail	Truck*	Water
raw coating materials	Any material used in a coating where no primary source data is available.	0 kilometers	1,207 kilometers	0 kilometers
plastics (including polymer-based materials: excluding textiles)		0 kilometers	1,218 kilometers**	1,545 kilometers**
steel (for packaging)	32 base metal in primary or semifinal forms & in finished basic shapes.	904 kilometers**	1500 kilometers	1,340 kilometers**

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).

Distances taken from the US Department of Transportation's Research and Innovative Technology Administration (RITA) website's "TranStats."

* Truck distances represent round trip distances, as the assumption is made that the delivery truck returns empty after making the delivery.

** 2007 US DOT Shipment Characteristics by Standard Classification of Transported Goods (SCTG) Commodity Code Table 7

4.2 Construction Stage (ISO 21930:2017 Modules A4-A5)

The construction stage starts with the packaged and finished coating leaving the production site and ends with the finished coating being installed/applied and cured onto the flooring substrate at the 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 applies it to the desired substrate where it fully cures.

A coating may go though many facilities before delivery to point of sale. Several legs of distribution and storage may occur for one resinous floor coating system, e.g., storage at a distribution center, installer warehouse, and a retail location (which is rare for this product category).

Intercompany movement shall be accounted for whether or not facilities fall under operational control of the reporting company. Transportation mode(s) and distances shall be based on primary data to the extent possible. If primary source data is not feasibly obtainable, 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
North American Default Material Transportation Distances in Design and Construction Process Stage

Raw material / classification grouping		Distance (kilometers)			
		Rail	Truck*	Passenger Vehicle (Single-Trip)	Water
finished products to distribution center	Any finished product where no primary source data is available.	0 kilometers	402 kilometers	0 kilometers	0 kilometers
finished products from distribution center to point of sale	Any finished product where no primary source data is available.	0 kilometers	804 kilometers	0 kilometers	0 kilometers
finished products from point of sale to application site	Any finished product where no primary source data is available.	0 kilometers	0 kilometers	8 kilometers	0 kilometers

NOTE — The average transport distances could also be used for complete components or units.

Distances estimated from industry consensus as conservative values.

* Truck distances represent roundtrip distances, as the assumption is made that the delivery truck returns empty after making the delivery.

Emissions associated with installation of the resinous floor coating systems, including the curing process and any waste materials generated (including packaging waste) shall be reported in module A5. Emissions that occur during the curing process shall not be reported in the B1 use phase module.[6]

It shall be assumed that 2% of the wet mass of the coating remains unused and is properly disposed as solid waste. This value was determined via industry consensus during the PCR development process and represents a conservative estimate. For many resinous floor coatings, the application does not require energy or generate smog-forming emissions (e.g., no-VOC coatings).

For resinous floor 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. If no application-efficiency is available, a 90% application efficiency shall be used as a conservative estimate.

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).

In accordance with the requirements of ISO 21930:2017, the impact from the activities normally considered in Module A1-A3 (production stage) and in Module A4 (transport to site) for the mass of product wasted during application are included in the Module A5 and not Modules A1 to A4. Additionally, waste processing of the packaging system shall also be accounted in module A5.

In the absence of primary data for end-of-life treatment of packaging materials, the most current version of the US EPA Municipal Solid Waste (MSW) data, US EPA WARM model, or substitute shall be used for the United States. For products outside the United States, a regionally or nationally appropriate data source shall be used to determine the percent of each material in the packaging that can be recycled versus landfilled.

Table 2 on page 36 in ISO 21930:2017 shall be reproduced and completed in the final EPD.

[6] This decision was reached by the PCR Committee to avoid any confusion regarding when certain emissions occur, especially as not all emissions may occur immediately (i.e. within a few hours) after applying the resinous floor coating system. Additionally, the coating industry is regulated on its product emissions and therefore stresses consistency with those regulations which do not specify a specific time horizon for emissions over the voluntary standards used by the LCA community (which may not be totally conformant with federal or local regulations).

4.3 Use Stage (ISO 21930:2017 Modules B1-B5)

The use stage begins after the resinous floor coating has fully cured (in the occupied space and ends with any coating entering the end-of-life stage.

Typical processes to be included for the use stage are:

- cleaning and maintenance; and
- necessary recoats occurring during the usage time of 60 years.

Maintenance in the form of cleaning is necessary for the upkeep of resinous floor coating systems. One of the benefits of resinous floor coatings is that they typically require less intense cleaning that other non-coating flooring systems. For example, some floor coatings (especially ones common in residential settings) can be maintained simply by sweeping or brushing. However, since resinous floor coatings are often applied in commercial or industrial spaces, some additional impacts from cleaning shall be considered.

All resinous floor coating systems shall conservatively assume daily cleaning using a mop and cleaning solution over the lifetime of the coating. The cleaning solution shall be whatever is deemed appropriate by the product manufacturer given the resinous floor coating chemistry and application setting being reported in the EPD. The cleaning solution used shall be disclosed in both the Project Report and EPD. It shall be assumed that a cleaning event (1 gallon of mop water with an added ½ cup of cleaning solution) be able to accommodate 100 m^2. As such, to satisfy the 60 year time frame functional unit, a total of 21,840 cleaning events will take place, corresponding to 218.4 events for the smaller surface area considered by the functional unit (1 m^2 vs. 100 m^2). Additionally, another 1.6 cleaning events shall be added to account for any spot cleaning events that may occur as well. **As such, the total impact of these 220 cleaning events shall be reported in module B2 of the LCA and subsequent EPD.**

It may be possible that the impacts reported in module B2 may be the same between product lines for a company, but it should be recalculated for each EPD given constantly improving inventory data and LCA assumptions in general. Finally, the impact of manufacturing, transporting, packaging, etc., of the mop itself shall not be included within as it may be used for other cleaning purposes beyond the coated area, lack of primary data, and overall difficulty in relating its impacts back to the functional unit stated in this PCR. As such, only the impact of the usage of the mop shall be considered in module B2.

As mentioned in Section 3.3 of this PCR, multiple coats and/or repaints may be needed to satisfy the functional unit stated in Section 3.2. These recoats shall be treated as 'replacements' and reported in Module B4 for the purposes of the LCA calculation and EPD creation. These recoats shall be calculated in the same way the initial coating system was for Modules A1-A5 to ensure impacts are consistent between recoats.

It may be possible that certain products may not have impacts in Modules B3 and B5-B7, but this shall be assessed on a case to case basis.

4.4 End-of-life Stage (ISO 21930:2017 Modules C1-C4)

The end-of-life stage begins when any applied or unused resinous floor coating 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 product, other unused product;
- incineration; and
- landfilling, landfill maintenance, decomposition emissions.

Based on data from the coating industry's PaintCare® program, it shall be assumed that waste coatings travel 11 kilometers 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 may be credited in Module D using the Avoided Burden Method[8] consistent with the Allocation Rules in Section 5 of this PCR.

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 US EPA WARM model.

[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

Emissions occurring once any material is deposited to landfill shall be assessed using a 100-year timeframe.

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

4.5 Benefits beyond system boundary (ISO 21930:2017 Module D) – Optional

Although not a formal life cycle stage, if a product system has potential benefits outside of the system boundary such as from recycling, reuse, energy recovery, etc., it may be reported here. This does not include impacts from allocated co-products.

Typical processes that are considered in Module D are:

- energy recovery from incineration;
- recycling efforts; and
- reuse of unused coating (if applicable).

Documentation shall be provided to ensure these activities actually take place. Additionally, since Module D is not considered a life cycle stage, its results do not affect the overall/total LCIA metrics reported in the EPD, but instead shall be reported separately for purpose of transparency.

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). Additionally, the co-product allocation guidance provided in in ISO 21930:2017 Section 7.2.5, shall be followed. Since there will be cases were allocation cannot be avoided, the following hierarchy of allocation methods is preferred:

- mass, or other biophysical relationship; and
- rconomic 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 can be defined using the equation:

avoided burden=(material recycling rate) × (functional unit) × [(impact of virgin production)- (impact of recycling)][9]

This equation should only apply to packaging end-of-life streams and shall be reported in a way consistent with Table 4 in ISO 21930:2017 and can only be reported in Module D.

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

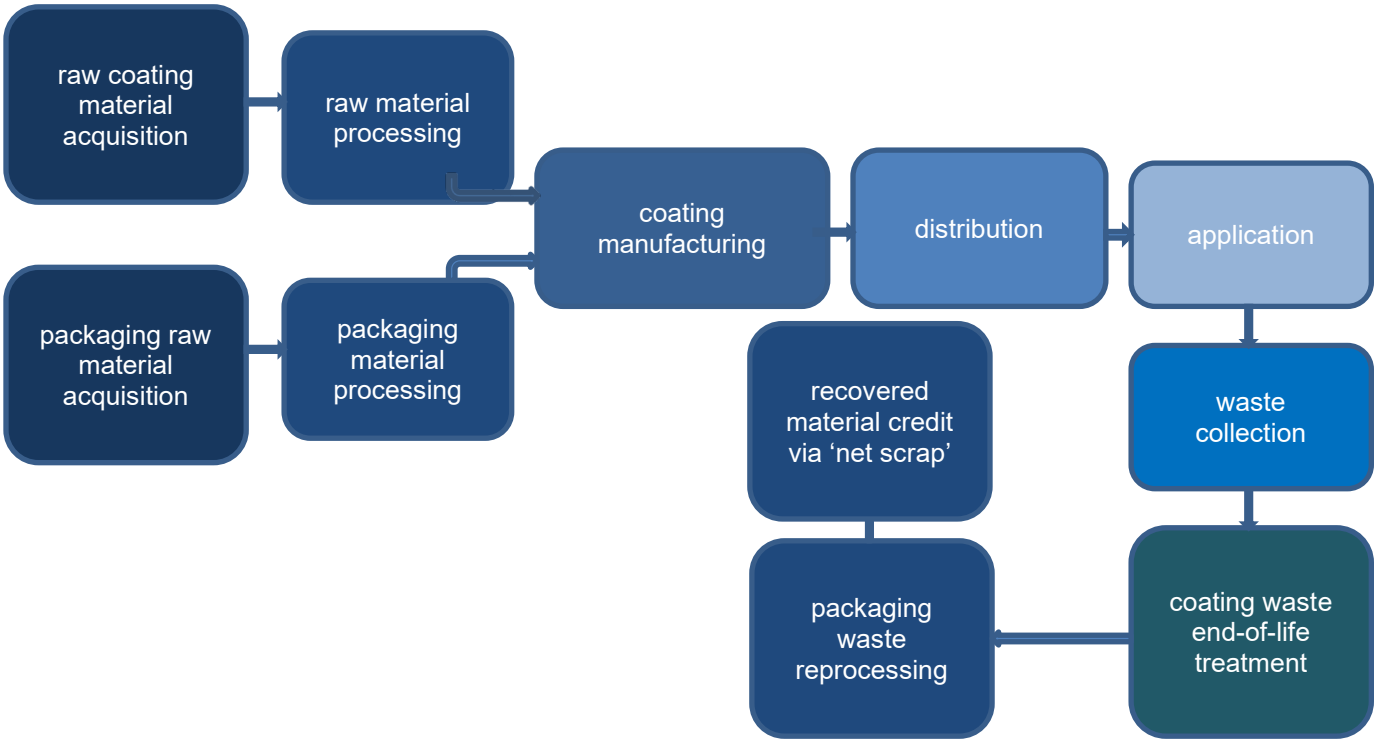


Figure 3
Process map illustrating avoided burden approach to recycling

[9] Example processes could include transportation for recycling, material processing, etc.

6 UNITS AND QUANTITIES

International System of Units (SI units) shall be used for both the LCA and the EPD as described in ISO 21930:2017 Section 7.1.10. 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:

— 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;

— data should represent the technology(ies) and process(es) in current use;

— data quality assessment shall conform to ISO 14044:2006, Section 4.2.3.6;

- data quality assessment shall, at a minimum, address the following:
  - time-related coverage: age of data and the minimum length of time over which data was collected;
  - geographical coverage: geographical area from which data for unit processes was collected to satisfy the goal of the study;
  - technology coverage: specific technology or technology mix; and
  - uncertainty of the information (e.g., data, models and assumptions):
    - may include quantitative estimation of uncertainty (optional).
- suitable data quality assessment frameworks include (but are not limited to):
  - USLCI Data Guidelines;[10]
  - ILCD Handbook;[11] and
  - 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 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.

[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_GIBrvSwWXTfHcRMcaU96qG61bU=?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

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 21930:2017 Section 7.1.9.

All inputs and outputs shall account for a 100 year time period from the year stated by the data set. This time period may be extended if relevant, but justification must be included in the Project Report.

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 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:

- 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.

- acidification of land and water sources (AP) [kg SO_2-eq]:
  - TRACI 2.1; outside North America, regionally applicable methodologies.
- photochemical ozone creation (SFP, or “Smog Formation”) [kg O_3 eq / kg of emission]:
  - TRACI 2.1; or outside North America, regionally applicable methodologies.
- eutrophication (EP) [kg N eq / kg of emission];
  - TRACI 2.1; or outside North America, regionally applicable methodologies.
- 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 21930:2017 Section 8.2.2.1.

7.6 Sensitivity analysis

Given the relevance of the coating’s assumed durability, 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 requiring multiple lifetimes be considered and reported in the EPD, no additional sensitivity analyses are required for the creation of the EPD. However, they can be conducted and included if desired.

7.7 Project report

A project report shall be created **and externally verified** per the requirements of ISO 21930:2017 Sections 10 and 11. Specifically, a project report shall contain the following:

— general aspects:

  — author(s) of LCA study;
  — date of report; and
  — statement that the report is conformant to ISO 21930:2017 and the reference PCR.

— goal of the study:

  — reason for completing the study; and
  — intended application and audience (B2B).

— scope of the study:

  — functional unit;
  — relevant technical specifications;
  — system boundary per ISO 21930:2017 guidelines;
  — any omissions (data or processes); and
  — cut-off criteria.

— LCI:

  — description of data sources (primary, secondary, generic, literature, etc.);
  — description of unit processes used to model the life cycle stages;
  — data quality assessment;
  — treatment of missing data; and
  — allocation rules – justification for use, descriptions, and statement that they were uniformly applied.

— LCIA:

  — LCIA procedures;
  — calculations;
  — results and relationship to LCI results;
  — characterization Method (i.e., TRACI for North America); and

- statement on limitations of LCA and midpoint impact categories (i.e., potential impacts).

- interpretation:

  - results;
  - assumptions;
  - limitations of the study;
  - data quality assessment; and
  - transparency into any value choices and expert judgements.

This report shall be submitted for external validation before the EPD is created and published. The Project Report is not publicly disclosed and may contain confidential information. Section 13 details what information must be publicly reported through the EPD.

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 21930:2017 Section 10.3, 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 module (Fig. 2), and as totals:

- non-renewable primary resources used as an energy carrier (MJ);

— nonrenewable primary resources with energy content used as a material (kg or MJ);

— renewable primary resources used as an energy carrier (MJ);

— renewable primary resources with energy content used as a material (kg or MJ);

— recovered energy from disposal of waste in previous systems - for example, combustion of landfill gases (MJ);

— abiotic depletion potential for fossil resources used as energy and materials (MJ). The LCA practitioner can report Abiotic Depletion Potential for Fossil Resources Used as Energy and Abiotic Depletion Potential for Fossil Resources used as Material, combined or individually; and

— consumption of freshwater (m^3).[13]

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 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.

ISO 21930:2017 also requires the reporting of:

— secondary materials (kg);
— renewable secondary fuels (MJ); and
— nonrenewable secondary fuels (MJ).

[13] 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 across all modules shall be classified in the EPD as:

- hazardous waste (kg);[14] or
- nonhazardous waste (kg).

These shall be disclosed by life-cycle module, as totals in the EPD.

Given concerns about inconsistent or nonexistent waste flows in commercially available LCIs, the following statement shall accompany the waste metrics in the results section or as a footnote following the waste metric reporting of the EPD:

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

If relevant to the product system assessed by the EPD, carbon uptake and emission shall be reported as described in Section 3.6 of this reference PCR and conformant with ISO 21930:2017.

Finally, quantities of high-level or intermediate/low-level radioactive waste shall be reported by life-cycle module and as totals per ISO 21930:2017.

8.3 Declaration of potential environmental impacts

Life cycle impact assessment category indicator results shall be reported separately for the product stage, construction stage, use stage, and end-of-life stage, as well as the total life cycle results. Users may also report impact category indicatory results by individual coating layer if desired, although impacts for product system total and for each life cycle stage shall still be reported as well.

[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, construction stage, use stage, and end-of-life stage as well as total life cycle results as described by Sections 4.1 through 4.4 of this document.

- climate change [kg CO_2-eq];
- depletion of the stratospheric ozone layer [kg CFC-11 eq / kg of emission];
- acidification of land and water sources [kg SO_2-eq];
- eutrophication [kg N eq / kg of emission]; and
- 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 21930:2017, Section 8.4.2, 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, determined 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 21930:2017, Sections 8.2, 8.3, and 8.4. Identification of the significant environmental aspects should conform to ISO 21930:2017, Section 8.4 and ISO 14025:2006, Section 7.2.4. EPDs may also included the potential effects of emissions on human health and toxicity as described below.

EPDs may report impacts related to human health, the environment, or both using the USEtox method. If reported in the EPD, it shall be reported in the LCIA section and reported by life cycle module and as a total with an accompanying paragraph describing its results in detail.

The decision to make human and/or ecotoxicity 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.[15] 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; and

— preferred waste management option for unused coating.

10 INDEPENDENT VERIFICATION

All verification of EPD, LCA, LCI and additional environmental information shall conform to the following ISO 14025:2006, 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, Section 8.1.2;

[15] 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.

— independent verification of data from LCA, LCI and information modules, and of additional environmental;

— information; see ISO 14025:2006, Section 8.1.3;

— independent verification of the EPD; see ISO 14025:2006, Section 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, Section 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, Section 8.2.3, and

— independent verifier of the EPD, according to provisions given in ISO 14025:2006, Section 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.[16]

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.

[16] Federal Trade Commission www.ftc.gov

US EPA, *Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI).*[17]

USEtox, *The UNEP-SETAC toxicity model: Recommended characterisation factors for human toxicity and freshwater ecotoxicity in life cycle impact assessment* (2008). The International Journal of Life Cycle Assessment 13, 532-546.

US EPA, *Waste Reduction Model (WARM)*[18]

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

World Business Council for Sustainable Development's Global Water Tool.[19]

World Resources Institute (WRI), *Draft Product Life Cycle Accounting and Reporting Standard*[19]

12 GLOSSARY

12.1 Acronyms and abbreviated terms

ACA: American Coatings Association

ASTM: ASTM International, a standards development organization that serves as an open forum for the development of international standards. ASTM methods are industry-recognized and approved test methodologies for demonstrating the durability of a various coating types in the United States.

ecoinvent: A life cycle database that contains international industrial life cycle inventory data on energy supply, resource extraction, material supply, chemicals, metals, agriculture, waste management services, and transport services.

EPA WARM model: United States Environmental Protection Agency Waste Reduction Model.

[17] US EPA, Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) www.epa.gov/nrmrl/std/sab/traci/

[18] US EPA Waste Reduction Model www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

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

EPD: Environmental Product Declaration. EPDs are form of as Type III environmental declarations under ISO 14025:2006. They are the summary document of data collected in the LCA as specified by a relevant PCR. EPDs can enable comparison between products if the underlying studies and assumptions are similar.

GaBi: Created by thinkstep, GaBi Databases are LCA databases that contain ready-to-use Life Cycle Inventory profiles.

LCA: Life Cycle Assessment. A technique to assess environmental impacts associated with all the stages of a product's life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling), as defined in ISO 14040:2006.

NCSS: NSF International's National Center for Sustainability Standards

PCR: Product Category Rule. A PCR defines the rules and requirements for creating EPDs of a certain product category, as described in ISO 14025:2006.

12.2 Terminology

adhesion: the degree of attachment between two surfaces held together by interfacial forces.

basecoats: coatings applied to the surface after preparation and before the application of a finish coat.

commercial project: Projects not used for residential, manufacturing, processing, or assembly purposes. Common commercial project types include education, healthcare, hospitality, entertainment, retain, and construction.

generic data: Defined by the ILCD handbook as "a generic data set has been developed using at least partly other information then those measured for the specific process. This other information can be stoichiometric or other calculation models, patents and other plans for processes or products, expert judgment etc. Generic processes can aim at representing a specific process or system or an average situation. Both specifically measured data and generic data can hence be used for the same purpose of representing specific or average processes or systems."

failure: The physical degradation of the floor surfacing material which would require substantial or complete removal in order to return the floor to serviceable condition.

industrial project: Any project where the primary activity includes the manufacture, production, processing, assembly, or handling of goods or materials. This could include use conditions such as heavy wheeled traffic or the use of fixed of moving machinery. For example, in a maintenance facility or as an automotive shop.

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

market service lifetime: The estimated lifetime of a resinous floor coating based off the predicted use pattern of the product type.

pigment: The material(s) that give a coating its color.

primers: materials applied to a surface to promote adhesion between the substrate and subsequent coats.

primary materials: Resources made from materials initially extracted from nature. Examples include titanium dioxide ore, petroleum, etc. that are used to create basic materials used in the production of coatings (e.g., pigment, solvents).

resin / binder: Acts as the glue or adhesive to adhere the coating to the substrate.

secondary materials: Materials that contain recovered, reclaimed, or recycled content that is used to create basic materials for the production of coatings (e.g., aluminum scrap).

technical service lifetime: The estimated lifetime of a coating based solely on its hiding and performance characteristics determined by industry consensus values.

topcoat: the final layer of coating put onto a surface over another layer(s).

13 EPD FORMAT

The format of the EPD shall be as follows:

- front page:
  - 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 must be carried out at the construction works level per ISO 21930:2017 guidelines. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-to-case basis."

  - PCR identification;
  - picture of product or family and brief description of product;
  - product category and subcategory;
  - manufacturer's name and contact information;
  - content of the product consistent with Section 8.1;
  - information on the EPD program operator;
  - date of certification and period of validity;
  - functional unit:
    - market and design lifetimes used in assessment.

— overall data quality assessment score (poor, fair, good, or very good);

— site(s), manufacturer or group of manufacturers, or those representing them, for whom the results of the LCA are representative; and

— information on where explanatory material can be obtained.

— product definition and characteristics:

— CAS Numbers, quantities, and description of any hazardous substances contained within the product system;

— description of product's intended use and any product codes if relevant; and

— additional product attributes:

  — components for reuse;
  — materials for recycling;
  — materials for energy recovery; and
  — recovered energy from the product system.

— key environmental parameters, as specified in *Impact Assessment Categories*, Section 7.5:

— climate change [kg CO_2-eq];
— depletion of the stratospheric ozone layer [kg CFC-11 eq / kg of emission];
— acidification of land and water sources [kg SO_2-eq];
— eutrophication [kg N eq / kg of emission]; and
— formation of smog [kg O_3 eq / kg of emission].

— product specifications, as described in Section 2;

— material and energy resources, as specified in *Parameters to be Declared in the EPD*, Section 8.2, sorted by:

  — depletion of non-renewable energy resources (MJ);
  — depletion nonrenewable material resources (kg);
  — use of renewable material resources (kg);
  — use of renewable primary energy (MJ);
  — consumption of freshwater (m^3);
  — hazardous waste (kg);
  — nonhazardous waste (kg);
  — high-level radioactive waste (kg); and
  — intermediate and low-level radioactive waste (kg).

— biogenic carbon updates and emissions (if relevant):

  — biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within bio-based products, occurring in each module;

  — biogenic CO_2, reporting the removals and emissions associated with biogenic carbon content contained within the bio-based packaging, occurring in each module;

  — CO_2 from calcination and carbonation, reporting the emissions and uptake of CO_2 from calcination and carbonation occurring in the relevant modules;

  — biogenic CO_2, reporting the emissions from combustion of waste from renewable sources used in product processes;

  — CO_2 emissions from combustion of waste from non-renewable sources used in product processes.

— declarations of technical information and scenarios (ISO 21930:2017 Section 9.4);

— emissions and wastes;

— additional environmental information per *Other Environmental Information,* Section 9;

— data quality assessment and disclosure and explanation of any data gaps; and

— relevant references.

All results must be reported and formatted in a way consistent with ISO 21930:2017 guidelines.

In addition to the above, a statement as given in Figure 3 of ISO 21930:2017 (reproduced below) shall be completed and included in the type III environmental declaration.

ISO 21930:<insert year of publication>— serves as the core PCR <Sub-category PCR, if relevant> <PCR review[a,b,c] was conducted by:> <Sub-category PCR review[ade] was conducted by:> <name and organization of the panel chair, and their contact information[f] >
Independent verification of the declaration and data, according to ISO 21930: <insert year of publication> and ISO 14025: <insert year of publication> ☐ internal ☐ external
Third party verifier[g]: <Name of the third party verifier>
[a] If relevant. [b] Any overarching PCR shall be in accordance with this document, particularly 6.1 and 6.2. [c] Any overarching PCR review shall be in accordance with 6.1. [d] Sub-category PCR shall be in accordance with 6.1, 6.2 and 6.3. [e] Sub-category PCR review shall be in accordance with 6.3. [f] The specific details of the review, including those to be named in the EPD, are the responsibility of the Programme Operator. [g] Where appropriate — optional for B2B communication; mandatory for B2C communication (see ISO 14025:2006, 9.4).

Figure 4

ISO 21930:2017 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.[20]

[20] NSF Program Operator Instructions available at http://www.nsf.org/newsroom_pdf/NSF_Program_Operator_Instructions-news.pdf