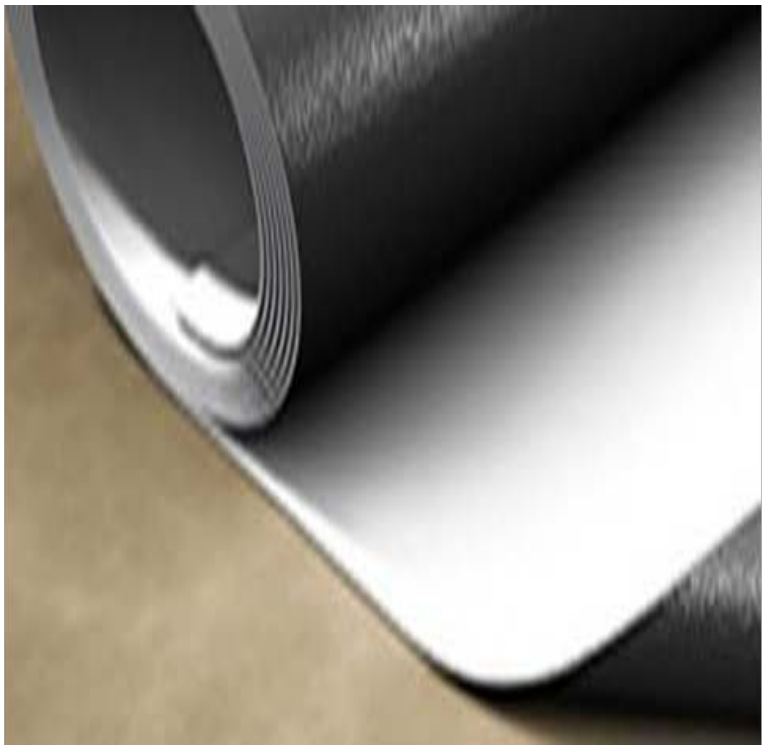
Product Category Rule

for Environmental Product Declarations

PCR for Single Ply Roofing Membranes



Program Operator

NSF International

National Center for Sustainability Standards

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PRODUCT CATEGORY RULES REVIEW PANEL

Program Operator

NSF International

Recommended for adoption by

The PCR Committee for Single Ply Roofing Membranes

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.

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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.

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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 <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 THE SINGLE-PLY ROOFING INDUSTRY (SPRI)

The development of this PCR was supported by the Single Ply Roofing Industry (www.spri.org) and its members.

SPRI is a collection of commercial roofing industry experts dedicated to providing an open forum for discussion, education, and innovation. We provide ongoing resources and expertise for contractors, architects, and building owners.

As the leading authority in single-ply roofing, the SPRI and our network deal exclusively with thermosets, thermoplastics, and modified bitumens.

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1 SCOPE

Per ISO 21930:2017, Section 1, with the following additions:

— This sub-product category rule (PCR) addresses and enables the development of single-ply roofing membrane EPDs from cradle-to-grave.

— The materials commonly used in single-ply roofing membranes are listed in Table 1:

Table 1

Materials	Description / specification
poly(vinyl chloride) PVC	ASTM D4434
ethylene-propylene-diene terpolymer (EPDM)	ASTM D4637
ketone ethylene ester (KEE)	ASTM D6754
thermoplastic polyolefin (TPO)	ASTM D6878

2 NORMATIVE REFERENCES

The following documents are referred to in the text. For undated reference, the latest edition of the referenced document (including any amendments) applies.

ISO 21930:2017 *Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services*

3 TERMS AND DEFINITIONS

While this PCR will likely be used primarily in North America, it may be used in other regions where program operators deem it appropriate. Per ISO 21930:2017, Section 3, with the following additions:

single-ply roofing membrane: Single-ply roofing membranes are thermoplastic or thermoset membranes of compounded synthetic materials manufactured in a factory for use in roofing.

EPD brief: A public report of EPD results that includes less detailed information about the LCA to reflect market demand (e.g., LEED v.4.1) for selected impact categories.

square meter (metre) of single-ply roofing membrane: Quantity of single-ply roofing membrane, which occupies an area of one square meter (metre).

net consumables: Items used during manufacturing, such as lubricants, grease and oils.

product specific EPD: EPD results for a specific product or group of single-ply roofing membranes, categorized by performance and developed by a manufacturer for a specific production facility location(s).

industry average EPD: EPD results for a specific product or group of single-ply roofing membranes categorized by performance for a specified region and or group of manufacturers.

hazardous waste: Waste identified as hazardous according to regulations applicable in the market for which the EPD is valid. For the US market, wastes are hazardous if they are regulated under the Resource Conservation and Recovery Act <www.epa.gov/rcra>. See also 40 CFR 261.33 <www.govinfo.gov/content/pkg/ CFR-2011-title40-vol26/pdf/CFR-2011-title40-vol26-sec261-33.pdf>. For the Canadian market, wastes are hazardous if they are regulated under the Canadian Environmental Protection Act, 1999 Regulations <www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/permit-hazardous-wastes-recyclables/management.html>.

NOTE — hazardous waste does not include radioactive waste. See ISO 21930:2017, Section 7.2.14.

nonhazardous waste: Commercial / industrial waste that is not hazardous, e.g., leftover or waste single-ply roofing membranes.

4 ABBREVIATED TERMS

Per ISO 21930:2017, Section 4, with the following additions:

CEN: European Committee for Standardization
LEED: Leadership in Energy and Environmental Design
USGBC: US Green Building Council
GBI: Green Building Initiative

5 GENERAL ASPECTS

5.1 Objectives of this PCR

Per ISO 21930:2017, Section 5.1, with the following additions:

— The primary objective of this sub-category PCR is to provide common rules specific to single-ply roofing membranes for the application of ISO 21930:2017 for building and civil engineering works.

— Additional objectives include to:

— encourage single-ply roofing membrane producers to quantify, report, better understand and reduce the environmental impacts of single-ply roofing membranes;

— promote transparency and incentivize manufacturer specific upstream data;

— represent single-ply roofing membrane appropriately following international standards for building materials and products;

— specify the data quality to be attained in single-ply roofing membrane EPDs;

— support the use and guidance of EPDs in sustainable design construction programs and rating systems;

— address requirements for creating an industry average EPD to enable a pathway towards comparative assessment against company specific EPDs (per LEED v.4.1 MR Credit, *Building product disclosure and optimization – Environmental declaration*s, and ANSI-GBI 01-2019, *Green Globes Assessment Protocol for Commercial Building*s); and

— enable consistent and comparable reporting of LCA results related to single-ply roofing membrane production.

5.2 Life cycle stages

Per ISO 21930:2017, Section 5.2, with the following clarification:

— This sub-category PCR enables reporting of all kinds of EPDs outlined in ISO 21930:2017, Section 5.2.2, including cradle-to-gate EPDs, cradle-to-gate with options EPDs, and cradle-to-grave EPDs.

5.3 Average EPDs for groups of similar products

Per ISO 21930:2017, Section 5.3, with the following clarifications and additions:

— Examples of average EPD grouping for single-ply roofing membrane products include same material, but different thicknesses.

— If any environmental indicators for products included in the average differ by more than ± 10%, the EPD shall report the range of variation for each impact category.

— Manufacturers who participated in the industry average may benchmark new product individual Type III EPDs against an industry average EPD, if at a minimum, the product meets the ASTM specification and thickness represented in the industry average EPD. Manufacturers who did not participate in the industry

average, product specific EPDs may be developed, but shall not be compared to the industry average Type III EPD.

— For full transparency, product specific EPDs are encouraged.

5.4 Use of EPDs for construction products

Per ISO 21930:2017, Section 5.4, with the following clarification and addition:

— This PCR is intended to be used to create EPDs for use in business-to-business (B2B) and business-to-consumer (B2C) communication. For B2C EPDs, a cradle-to-grave EPD is mandatory.

5.5 Comparability of EPDs for construction products

Per ISO 21930:2017, Section 5.5, with the following clarifications:

— EPDs may enable comparison between products, but do not themselves compare products, as stated in ISO 14025, Sections 4 and 6.7.2. It shall be stated in EPDs created using this PCR that only EPDs prepared from cradle-to-grave life-cycle results, and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products. The basis of a comparison shall include the product application in accordance with ISO 21930, Section 5.5, and clearly defined and justified scenarios for modules A4, A5, B1 to B7 and C1 to C4 (see Figure 1).

— EPDs based on cradle-to-gate and cradle-to-gate with options information modules shall not be used for comparisons. EPDs based on a declared unit shall not be used for comparisons.

5.6 Documentation

Per ISO 21930:2017, Section 5.6, with the following additions:

— In addition to the EPD and project report as outlined in ISO 21930:2017, the results of the EPD may be reported in an EPD brief. EPD briefs may include less detailed information about the LCA, may aggregate life cycle stages A1 to A3, A4 to A5, B1 to B7 and C1 to C4, and may have fewer environmental impact categories and/or inventory indicators. The requirements for an EPD brief are provided in Section 9.5.

6 PCR DEVELOPMENT AND USE

Per ISO 21930:2017, Section 6, with the following addition:

— This PCR document is effective for five (5) years from the latest date of publication. If after five years, relevant changes in the product category or other relevant factors have occurred (for example, evolution of LCA methodology in ISO 21930:2017), the document will be revised. See Section 5.5 for comparability.

7 PCR FOR LCA

7.1 Methodological framework

7.1.1 LCA Modeling and calculation

Per ISO 21930:2017 Sections 7.1.1, and 7.2.3 to 7.2.6.

7.1.2 Functional unit

Per ISO 21930:2017, Section 7.1.2, with the following clarifications and addition:

— The functional unit shall be 1000 square meters of installed single-ply roofing membrane, including seams for a 75-year building service life. Explanation of the selected functional unit shall be stated clearly, including the product's reference service life, installation methods and all ancillary materials use such as ballasting, fasteners, and/or adhesives.

7.1.3 Declared unit

Per ISO 21930:2017, Section 7.1.3, with the following clarification:

— The declared unit shall be one square meter of single ply roofing membrane. Data and results may additionally be presented per imperial square yard or kilograms.

7.1.4 Reference service life (RSL)

Per ISO 21930:2017, Section 7.1.4, with the following additions:

— Reference service life of the building shall be assumed to be 75 years (per ASHRAE 189.1-2017 and ASTM E2921:2013) and the maintenance regime and number of replacements of the building product shall be declared accordingly.

— When the product reference service life is less than the assumed building service life (75 years), the aggregated product stage, construction process stage and end of life stage impacts (modules A1 to A5 and C1 to C4) associated with the number of replacements necessary to equal the reference service life of the building shall be included.

— The combined impacts of the original product and any replacements shall be determined by dividing the building service life (75 years) by the service life of the product, and the impacts multiplied by the result. If the result is a decimal, then it shall be rounded to the nearest tenth.

— Example 1: If the expected service life of a component is 25 years, the impacts would be multiplied by 3, thus normalizing the changeovers replacements to be equivalent to the assumed 75-year building service life.

— Example 2: If the expected service life of a component is 20 years, the impacts would be multiplied by 4 (75 RSL/ 20 service life = 3.75, rounded up to 3.8).

7.1.5 System boundary with nature

Per ISO 21930:2017, Section 7.1.5.

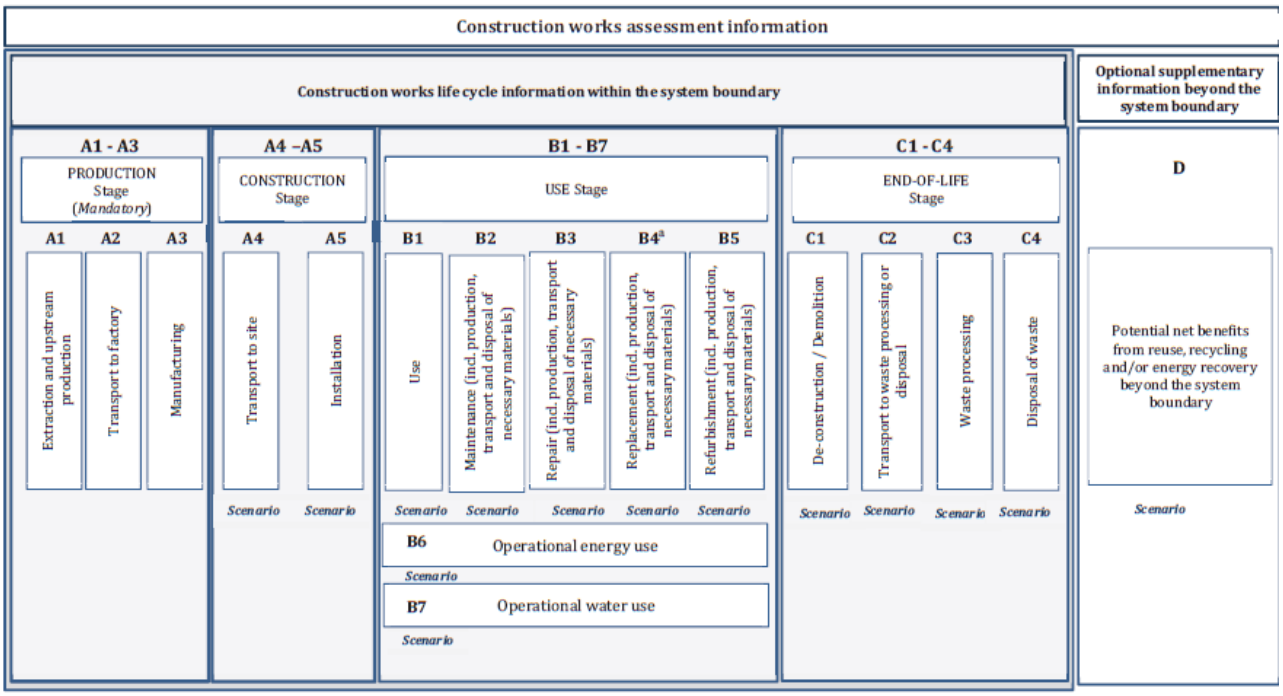
7.1.6 System boundary between products systems

Per ISO 21930:2017, Section 7.1.6.

7.1.7 System boundaries and technical information scenarios

Per ISO 21930:2017, Section 7.1.7, with the following additions:

— Figure 1 shows the life cycle stages and individual modules that shall be included within the LCA system boundary, depending on whether the EPD is B2B or B2C.



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

Figure 1

Life-cycle stages and individual models within the LCA system boundary (ISO 21930, Figure 2)

— Production Stage modules A1-A3 are mandatory for all B2B and B2C EPDs using this PCR.

— Items that may be excluded from the system boundary include:

— production, manufacture, and construction of manufacturing capital goods and infrastructure;

— production and manufacture of production equipment, delivery vehicles, and laboratory equipment;

— personnel-related activities (travel, furniture, and office supplies); and

— energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

7.1.7.1 General

Per ISO 21930:2017, Section 7.1.7.1.

7.1.7.2 A1 to A3, production stage

Per ISO 21930:2017, Section 7.1.7.2, with the following additions:

— Average or specific transportation of raw materials from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process) and including empty backhauls. In instances where primary transportation data do not exist, transportation distances listed in the US Department of Transportation, *Bureau of Transportation Statistics,* and US Census Bureau, *2017 Commodity Flow Survey,* shall be used for inbound raw materials transported to facilities located in the United States. For facilities located outside of the US, regionally or nationally application transportation distance and mode(s) shall be used if primary data is unavailable.

— Also included in this stage is the waste and scrap generated during production. Primary data on process yields and scrap rates shall be used if available. If specific equipment yields and scrap rates are not available, a facility average may be used. If waste materials are recycled, landfilled, composted, or combusted, the 2019 US EPA Waste Reduction Model (WARM version 15) provides an average transport end-of-life distance of 20 miles. This value shall be used for facilities located in the US when primary data is not available. Facilities not located in the US shall use primary data or, when not available, applicable regional or nationally representative values.

— Material recycling percentages for US-based facilities shall be based on US EPA Advancing Sustainable Materials Management: *2015 Fact Sheet*, unless primary data is available. Facilities located outside of the US shall use primary data or applicable regional or nationally representative material recycling percentages.

7.1.7.3 A4 to A5, construction stage

Per ISO 21930:2017, Section 7.1.7.3, with the following additions:

— A4 is optional. If provided, a description of the reference scenarios shall be part of the EPD.

— A5 is optional. If provided, a description of the reference scenarios shall be part of the EPD.

— Average or specific transportation of product from manufacturing site to building site, including empty backhauls. In instances where primary transportation data do not exist, transportation distances listed in the US Department of Transportation, Bureau of Transportation Statistics, and US Census Bureau, *2017 Commodity Flow Survey,* shall be used for inbound raw materials transported to facilities located in the US. For facilities located outside of the US, regionally or nationally application transportation distance and mode(s) shall be used if primary data is unavailable.

— Installation on the building site including all ancillary materials taking account of whether the roofing product is fully adhered or mechanically attached.

— In the absence of primary data on actual end-of-life treatment for the packaging materials, use US EPA MSW data, US EPA Warm model, or other regionally or nationally appropriate data source

— Manufacturing and transportation of tools used during the installation process are excluded.

— Additionally, Table 2 on page 36 in ISO 21930:2017 shall be reproduced in the final EPD.

7.1.7.4 Use stage

Per ISO 21930:2017, Section 7.1.7.4, with the following additions:

— B1 to B7 are optional. If provided, a description of the reference scenarios shall be part of the EPD.

— Typical processes in the use stage are:

  — maintenance or replacement of the product or parts of the product;
  — cleaning; and
  — regular inspections.

— Maintenance and inspections are to be modeled according to manufacturers' guidelines regarding the reference service life of the product, which must be based on a verifiable product performance history. Average transportation distance can be used when specific data is not available.

7.1.7.5 End-of-life stage

Per ISO 21930:2017, Section 7.1.7.5, with the following additions:

— C1 to C4 are optional. If provided, a description of the reference scenarios shall be part of the EPD.
— Use single-ply roofing industry average end-of-life disposal percentages if primary data is not available.

7.1.7.6 Benefits and loads beyond the system boundary

Per ISO 21930:2017, Section 7.1.7.6:

— Module D is optional. If provided, a description of the reference scenarios shall be part of the EPD.
— Typical processes that are considered in Module D are:

  — recycling efforts including post-consumer roof recycling; and
  — reuse of unused roofing membrane

— Supporting documentation must be submitted to verify the programs existence.

7.1.8 Criteria for the inclusion and exclusion of inputs and outputs

Per ISO 21930:2017, Section 7.1.8.

7.1.9 Selection of data and data quality requirements

Per ISO 21930:2017, Section 7.1.9, with the following additions:

— The use of specific or generic background data shall be documented. As a rule, the following distribution will be applied:

  — extraction or production or both of raw materials (specific or average background or both);

  — manufacturing of the product (primary);

  — data sources and any calculation procedures for the fuel mix for electricity generation shall be documented; and

— Hazardous waste shall be specified according to regulation such as US EPA Hazardous Waste Regulations or the Canadian Federal Hazardous Waste Regulation, or both as appropriate.

— When primary data is not available, national databases shall be used to the extent that they are applicable (for example, US Life Cycle Inventory Database, <www.nrel.gov/lci>). If appropriate, national data is not available, sources for similar technology adjusted for national boundary conditions (e.g., energy mix) may be used.

— Electrical energy data shall use eGRID, or sub-regions, or similar data to represent electrical energy production for the US. Preference shall be given to datasets that include transmission and distribution losses. If such regional data are not available, production mixes of the three continental interconnections (East, West, and Texas), as well as those of Hawaii and Alaska, may be used. For regions other than the US, country or region-specific processes shall be used for the manufacturing stage provided they are representative. The sources for electricity and the calculation procedure shall be documented.

— Credit may not be applied to LCA baseline when “green” power certificates are used, but certificates may be reported in the Additional Environmental Information section. Green power certificates must be available and provided to the program operator for the entire period of EPD validity.

— All data sources shall be specified, including database and year of publication (reference). Sources of data for transport models (Including transport mode, distances, and quantities to be transported) and thermal energy production shall be documented. Where proxy data is used in the absence of specific data for chemicals or other inputs, the source and justification for selection of the proxies shall be documented in the LCA report.

— The product content will be described in the declaration. Information protected under law as confidential does not have to be disclosed. In such cases, a notation that the information in confidential will be made along with a description of the function of the component.

— In the case of B2C EPDs, the amount of material used as input to enable the product to meet the functional unit requirements shall include related accessories and other materials (that is, ancillary materials), unless the reason for the omission of these is explained.

7.1.10 Units

Per ISO 21930:2017, Section 7.1.10, with the following additions:

— As noted in ISO 21930:2017, SI units shall be used. Optionally, EPDs may provide both US imperial and metric units using the following conversion factors.

Table 2

Unit conversion table

Convert from	Convert to	Multiply by
cubic yard (yd^3)	cubic meter (m^3)	7.654 549 E-01
square Foot (ft^2)	square meter (m^2)	9.290 304 E-02
foot (ft)	meter (m)	3.048 E-01
British thermal unit (BTU)	megajoule (MJ)	1.055 056 E-03
pound (lb)	kilogram (kg)	4.535 924 E-01

Source: NIST: <physics.nist.gov/Pubs/SP811/appenB9.html>

7.2 Inventory analysis

Per ISO 21930:2017, Section 7.2, with additional guidance as follows:

— If different allocation options are relevant and a deviation of greater than 20% is a foreseen outcome, a sensitivity analysis shall be initiated. These different allocation approaches and data sets shall be documented and declared in the EPD.

— In a production process in which more than one type of product is generated, it is necessary to allocate the environmental flow (inputs and outputs) from the process to the different products to get product-based inventory data.

— Allocation shall follow the requirements and guidance of ISO 14044:2006, Clause 4.3.4, and the coproduct allocation in ISO 21930, Section 7.2.5.

— As stated in ISO 21930, Section 7.2.8, carbonation shall be included in the environmental impacts during the production, use and end-of-life stages. This is typically not relevant to the single-ply roofing industry and should only be assed when relevant.

— Product biogenic carbon dioxide emissions shall be separately reported per ISO 21930, Section 7.2.12, where relevant and available, but is typically not relevant to the single-ply roofing industry.

— ISO 21930, Section 7.2.13, states to include the consumption (or net use) of freshwater as LCI indicator declaring water consumption related to the product during its life cycle. Consumption of freshwater should be based on the foreground system (operations under direct control of the product manufacturer) and shall not include consumption of rainwater unless relevant to the product's life cycle.

— Finally, waste allocated to the building product for the foreground system shall be classified as hazardous waste, defined by RCRA under 40 CFR § 261.33, and nonhazardous and in accordance with ISO 21930, Section 7.2.14.

7.3 Impact assessment indicators describing main environmental impacts derived from LCA

Per ISO 21930:2017, Section 7.3, with the following clarifications:

— Of note, ISO 21930:2017 greatly expands the indicators required to be reported. Often, the best currently available data such as industry average EPDs for upstream processes do not yet align with ISO 21930:2017.

— The impact categories of the life cycle impact assessment (LCIA) shall be calculated using characterization factors specified in version 2.1 of US EPA TRACI (Tool for the Reduction and Assessment of Chemical and Other Environmental Impact); or outside North America, regionally applicable methodologies, except global warming potential which shall be calculated using IPCC (AR5).

8 ADDITIONAL ENVIRONMENTAL INFORMATION

Significant environmental aspects not covered by the LCA shall be reported in the EPD, where relevant, as additional environmental information in accordance with ISO 21920:2017, Sections 8.2, 8.3, and 8.4, and ISO 14025:2006, Section 7.2.3. Identification of the significant environmental aspects should conform to ISO 21930:2017, Section 8.4, and ISO 14025:2006, Section 7.2.4.

9 CONTENT OF AN EPD

9.1 General

Per ISO 21930:2017, Section 9.1.

9.2 Declaration of general information

Per ISO 21930:2017, Section 9.2, with the following clarifications:

— A simple visual representation of the single-ply roofing membrane is not required.

— As the percentage of material components can be considered proprietary information, the list of materials should be reported in order of greatest mass and or aggregated by type to protect confidential information.

— Ingredients that are considered proprietary do not have to be disclosed in the EPD.

— Include the following table in lieu of ISO 21930:2017, Figure 3:

ISO 21930:2017 Sustainability in Building Construction — Environmental Declaration of Building Products: serves as the core PCR <Insert Single-Ply Roofing Membranes PCR V2 final name> serves as the sub-category PCR Sub-category PCR review was conducted by: <Insert name and organization of the panel chair and their contact information>
Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025: <insert year of publication> ☐ internal ☐ external
Third-party verifier: <name and contact information of third-party verifier>
For additional explanatory material: <name and email of manufacturer's representative>
<name and version of EPD software tool (if applicable)>

9.3 Declaration of methodological framework

Per ISO 21930:2017, Section 9.3, with the following additions and clarifications:

— The EPD shall include the following:

— a table summarizing the life cycle stages included in the EPD:

Product stage			Construction process stage		Use stage							End of life stage			
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal of waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4

— a table outlining the primary sources of data used to complete the upstream material LCI background data including the date or version number; and

— for industry average EPDs, include the date and source of industry data survey including a list of all companies who participated in the EPD data.

9.4 Declaration of technical information and scenarios

Per ISO 21930:2017, Section 9.4.

9.5 Declaration of environmental indicators derived from LCA

Per ISO 21930:2017, Section 9.5, with the following additions:

— As stated in ISO 21930:2017, Section 9.5.1 the following impact categories are required and shall be specified for all information modules in the EPD:

- global warming potential (GWP);
- depletion potential of the stratospheric ozone layer (ODP);
- eutophication potential (EP);
- acidification potential of soil and water sources (AP); and
- formation potential of tropospheric ozone (POCP).

The following clarifications shall be applied and notes added:

- Many of the impacts and inventory items included in ISO 21930:2017 are emerging and have high levels of uncertainty. If any of the impact categories and inventory items listed below are declared in the EPD, the following note must be included:

"Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories:

- *renewable primary energy resources as energy (fuel), (RPR_E);*
- *renewable primary resources as material, (RPR_M);*
- *non-renewable primary resources as energy (fuel) ,($NRPR_E$);*
- *non-renewable primary resources as material ($NRPR_M$);*
- *secondary materials (SM);*
- *renewable secondary fuels (RSF);*
- *non-renewable secondary fuels (NRSF);*
- *recovered energy (RE);*
- *abiotic depletion potential for non-fossil mineral resources (ADPelements).*
- *land use related impacts, for example on biodiversity and/or soil fertility;*
- *toxicological aspects;*
- *emissions from land use change [GWP 100 (land-use change)];*
- *hazardous waste*[1] *disposed;*
- *non-hazardous waste disposed;*

[1] As defined by RCRA under 40 CFR § 261.33 <www.govinfo.gov/content/pkg/CFR-2011-title40-vol26/pdf/CFR-2011-title40-vol26-sec261-33.pdf>.

- *high-level radioactive waste;*
- *intermediate and low-level radioactive waste;*
- *components for reuse;*
- *materials for recycling;*
- *materials for energy recovery; and*
- *recovered energy exported from the product system."*

— When upstream data specified in the PCR and/or used in calculating the EPD do not have data for select impact categories or inventory items, they shall be reported as an 'x' or '-' and not zero, and qualified with the note:

"Not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete. Use caution when interpreting data in these categories."

NOTE — ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017 <www.aclca.org>.

9.6 EPD Brief

A EPD brief may be published and report fewer impact categories than the EPD. An EPD brief must include all additional information and statements required in the EPD and provide a link to the EPD.

Add statement to the EPD brief:

"This EPD brief does not report all of the impact categories required by ISO 21930:2017. Additional detail and environmental impacts are reported in the complete EPD available."

A EPD brief may report a single result aggregating life cycle stages (A1 to A3, A4 to A5, B1 to B7 and C1 to C4) and at a minimum must report the following required impact categories and inventory items:

- global warming potential (GWP 100);
- ozone depletion potential (ODP);
- eutrophication potential (EP);

— acidification potential (AP);
— photochemical smog creation potential (POCP);
— abiotic depletion potential for non-fossil mineral resources (ADPelements);
— abiotic depletion potential for fossil resources (ADPfossil);
— total waste disposed (kg); and
— consumption of freshwater (per ISO 21930:2017, Section 7.2.13).

9.7 Declaration of additional environmental information

Per ISO 21930:2017, Section 9.6, with the following additions:

— The following optional additional information may be reported as a separate inventory item:

— carbon sequestered in product (kg). Methodology must be documented and publicly reported;

— roofing membrane reflectivity and the impacts on building energy consumption;

— other sustainability certification held by the manufacturer or its single-ply roofing products;

— 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;

— adhesive VOC g/L in adhered applications;

— organization’s adherence to any environmental management system, with a statement on where an interested party can find details of the system, if relevant; and

— instructions and limits for correct and efficient use, if relevant.

— The following references shall be provided at a minimum in the EPD:

— ISO 21930:2017, *Sustainability in Building Construction — Environmental Declaration of Building Products.*

10 PROJECT REPORT

Per ISO 21930:2017, Section 10.

11 VERIFICATION AND VALIDITY

Per ISO 21930:2017, Section 11 with the following additions:

— EPD calculations completed by software systems are permitted provided the software has been verified per similar procedures as verifying an EPD. The process used to verify the software calculations should be publicly accessible and referenced from the EPD.

— When a product specific EPD is aligned with an industry average EPD the following additional items are required:

— In order to evaluate the consistency of results between product specific EPDs and industry average EPDs either:

— The same LCA modeling software and version and background data shall be used to create the EPD, or

— The LCA modeling software and version shall test representative samples of the regionally-specific industry average benchmark data, and include in the EPD a report of the maximum percent difference for environmental impact categories: global warming potential (GWP), acidification potential (AP), eutrophicaton potential (EP) and photochemical oxidant creation potential (POCP). If a different LCA tool is selected, it shall be used to calculate environmental indicators for a sample of representative products taken from the published industry average LCA report. The variation of results produced by the selected LCA modeling software and version, compared to the published environmental indicators in the industry EPD shall be reported as a maximum percent variation for GWP 100, AP, EP or POCP. This is to provide transparency on the variability of results that stem from background data and models.

— An EPD shall be recalculated when changes to manufacturing practices are reasonably expected to result in a significant change to the EPD results.

— An EPD shall be recalculated when its period of validity is complete or when updates to the PCR result in significant changes to the EPD results.

— Significant changes are an increase or decrease of GWP 100, AP, EP or POCP by more than 5% of previously reported result.

12 REFERENCES

ASTM Standards[2]

ASTM C11 – 18b, *Standard terminology relating to gypsum and related building materials and systems*

ASTM C22 – 00(15), *Standard Specification for Gypsum*

ASTM E2921 – 16a, *Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems*

[2] ASTM International. 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. <www.astm.org>

ISO Standards[3]

ISO 6707-1: 2014, *Buildings and Civil Engineering Works — Vocabulary — Part 1: General Terms*

ISO 14021:1999, *Environmental Labels and Declarations — Self-declared Environmental Claims (Type II Environmental Labeling)*

ISO 14025:2006, *Environmental Labels and Declarations — Type III Environmental Declarations — Principles and Procedures*

ISO 14040:2006, *Environmental Management — Life Cycle Assessment — Principles and Framework*

ISO 14044:2006, *Environmental Management — Life Cycle Assessment — Requirements and Guidelines*

ISO 14067:2018, *Greenhouse Gases – Carbon Footprint of Products – Requirements and Guidelines for Quantification*

ISO 14050:2009, *Environmental Management — Vocabulary*

ISO 15686-7: 2017, *Buildings and Constructed Assets – Service Life Planning*, Parts -1, -2, -7 and -8

ISO 21930:2017, *Sustainability in Building Construction — Environmental Declaration of Building Products*

[3] International Organization for Standardization. Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland. <www.iso.org>

EN Standards[4]

EN 15804, *Sustainability of construction works — Environmental product declarations —Core rules for the product category of construction products*, January 2012.

Other References

American Center for Life Cycle Assessment 21930:2017. Guidance available at <www.aclca.org>.

ASHRAE 189.1-2017, *Standard for the Design of High-Performance Green Buildings.* Available at <www.ashrae.org>.

Athena Sustainable Materials Institute, *A Cradle-to-building with EOL stage Life Cycle Assessment for three thicknesses of white, SPPR PVC Roofing Membrane (40, 48 and 60 mils)*, prepared for the Chemical Fabrics and Film Association, March, 2016.

theGreenTeam Inc., *EPDM Roofing Association Life Cycle Inventory & Assessment*, August 2009[5]

GBI ANSI-GBI 01-2019, *Green Globes Assessment Protocol for Commercial Buildings*, 14 June 2019. Available at <www.thegbi.org/content/misc/ANSI-GBI_01-2019_Publication_-_final_6-14-19_.pdf>.

USGBC, *LEED v4.1 for Building Design and Construction*, 11 Jan 2019. Available at <www.new.usgbc.org/leed-v41>.

USGBC, PCR Committee Process & Resources: Part B, USGBC, 7 July 2017. Available at <www.usgbc.org/resources/pcr-committee-process-resources-part-b>.

US Department of Transportation Bureau of Transportation Statistics; *Preliminary 2017 Commodity Flow Survey*. Available at <www.bts.gov/cfs>.

[4] European Committee for Standardization (CEN). Avenue Marnix 17, B-1000 Brussels, Belgium. <www.cen.eu>

[5] theGreenTeam, Inc. 136 East 18th Street, Tulsa, OK 74119. <www.thegreenteaminc.com>

US Environmental Protection Agency, *Advanced Sustainable Materials Management: 2015 Fact Sheet, Assessing Trend in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the United States*, July 2018. Available at <www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf>

United State Environmental Protection Agency, *Waste Reduction Model (WARM)*, Version 15. Available at <www.epa.gov/warm/versions-waste-reduction-model-warm#15>.

***THE HOPE OF MANKIND** rests in the ability of man to define and seek out the environment which will permit him to live with fellow creatures of the earth, in health, in peace, and in mutual respect.*