

We built that.

Del E. Webb
School of Construction



ASU Ira A. Fulton Schools of
Engineering
Arizona State University



Roofing Alliance Faculty Workshop

Roofing and sustainability

Mark S. Graham

National Roofing Contractors Association

Helene Hardy Pierce

GAF Materials Corp.

Zebonie Suple

Johns Manville Roofing Systems



Cool roofs



Vegetative roofs



Rooftop PV



Designation: D7851 – 17

Standard Guide for Design of Sustainable, Low-Slope Roofing Systems¹

This standard is issued under the fixed designation D7851; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscripted epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide provides guidance and considerations related to designing sustainable low-sloped roofing systems, including exposed membrane roofs, membranes covered with vegetative (green) overburden systems, ballasted roofs, and protected membrane roofing assemblies. A sustainable roofing system minimizes environmental impact, conserves energy, and has maximized service life.

1.2 The primary purpose of a roofing system is to weatherproof the building's top surface. Implementing a sustainable roofing system is the intent of this guide.

1.3 This guide acknowledges that many factors outside the designer's control affect the longevity of a roofing system. The designer may rely on industry literature (X1.1) and personal experience with roofing systems to estimate the design life.

1.4 The premise of this guide is to focus attention on environmental and other factors that may affect the roofing system over its service life. By considering these factors and incorporating into the roofing system design certain features that mitigate these factors and their potential adverse effects on the roofing system, the roofing system would be expected to have a longer service life.

1.5 This guide includes materials used in roofing systems under jurisdiction of ASTM Committee D08 on Roofing and Waterproofing. The applicability of this guide to other systems and materials has not been determined.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.24 on Sustainability.

Current edition approved Feb. 1, 2017. Published February 2017. DOI: 10.1520/D7158_D7158M-17.

2. Referenced Documents

2.1 *ASTM Standards:*²

D1079 Terminology Relating to Roofing and Waterproofing

3. Terminology

3.1 *General*—Terms used in this guide are defined in Terminology D1079, except as defined below.

3.2 *Definitions:*

3.2.1 *design life*—the planned period of time during which the roofing system is expected by its designer to reliably perform its required functions, with minimal unplanned intervention.

3.2.2 *durability*—the ability of the roofing system to perform its required functions over a period of time within the environment for which it is designed and exposed.

3.2.3 *service life*—the period of time after installation during which a roofing system performs its required function(s) with minimal unplanned intervention.

4. Summary of Guide

Note 1—The sustainable roofing system design process consists of the following, sequential steps:

4.1 *Identification of Roofing System Demands, Functional Expectations, and Site Constraints*—The designer should determine factors, loads, and stresses that the roofing system must withstand as well as the impacts the roofing system may have on the environment the building interacts with. These factors apply limiting constraints for system and material selection and the associated installation process. There are also options for sustainable strategies and site and use constraints that will define the feasibility of sustainable strategies (for example, availability of sunlight for photovoltaic arrays).

4.2 *Determination of In-Service Performance Criteria and Functional Expectations*—The designer determines performance criteria and functional expectations of the roofing

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

ASTM D7852, “Standard Guide for Design of Sustainable, Low Slope Roofing Systems”



Designation: D8013 – 16 (Reapproved 2021)

Standard Guide for Establishing a Recycle Program for Roof Coverings, Roofing Membrane, and Shingle Materials¹

This standard is issued under the fixed designation D8013; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide provides information for the development of a program to reduce roof covering waste. The recycled roof coverings and any scrap roof cover materials may be reprocessed back into new roof coverings, into other roofing products, or into products other than roofing. This guide does not comment on the use or the inclusion of other recycled or recovered materials which may be used to increase the total amount of recycle material.

1.2 This guide addresses terminology, logistics, quality assurance, separation, or segregation in the recycling process of materials.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²
D1079 Terminology Relating to Roofing and Waterproofing
D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)³

¹ This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.24 on Sustainability.

Current edition approved Jan. 1, 2021. Published January 2021. Originally approved in 2016. Last previous edition approved in 2016 as D8013 – 16. DOI: 10.1520/D8013-16R21.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

2.2 *UL Standard:*⁴

UL 2809 Environmental Claim Validation Procedure for Recycled Content

2.3 *ICC Standard:*⁵

ICC International Building Code, current version

3. Terminology

3.1 *Definitions*—For definitions of roofing terms, see Terminology **D1079**. For definitions of recycling and recovery terms, see Guide **D7209**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bale, n*—waste that is compacted and secured as a bundle to facilitate handling, storage, and transportation.

3.2.2 *bulk box, n*—also known as bulk bin, skid box, tote box, or Gaylord, these are normally pallet size containers used for storing and shipping bulk quantities constructed of corrugated fiberboard, either double or triple walled.

3.2.3 *certificate of composition disclosure, n*—certificate describing certain properties of a recovered material from an external source, its formation and source, and the specific material shipment to which it applies.

3.2.3.1 *Discussion*—Examples of CCD information include polymer, molecular weight, percentage of inorganic material, contamination type and level, strength, modulus, impact and other mechanical properties; code or designation identifying the formulation and source information.

3.2.4 *chemical recycling, n*—processing of recovered material into a secondary raw material or product, with a significant change to the chemical structure of the material (such as cracking, gasification, and depolymerization), but excluding energy recovery or incineration.

3.2.5 *collection, n*—logistical process of moving waste from its source to a place where it can be recovered.

3.2.6 *contaminant, n*—unwanted substance or material defined according to the intended use.

⁴ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

⁵ Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, <http://www.iccsafe.org>.

ASTM D8013, “Standard Guide for Establishing a Recycle Program for Roof Coverings, Roof Membrane and Shingle Materials”

NSF/ANSI 347



Sustainability Assured for Single Ply Roofing Membranes

NSF/ANSI 347 Sustainability Assessment for Single Ply Roofing Membranes is the leading consensus standard for evaluating and certifying sustainable attributes of single ply roofing membranes over their entire product life cycle.

NSF Sustainability provides certification to the NSF/ANSI 347 standard. Single Ply Roofing Membranes, as defined by this standard, include, but are not limited to, membranes produced from EPDM (Ethylene Propylene Diene Terpolymer), KEE (Ketone Ethylene Ester), PVC (Poly Vinyl Chloride), TPO (thermoplastic polyolefin), and PIB (Polyisobutylene) products. This U.S. national standard was developed through a consensus-based public process by a multi-stakeholder group of manufacturers, suppliers, regulatory agencies, customers, end users, academia and other industry participants under NSF's facilitation. The purpose of this standard is to communicate accurate and verifiable information about the environmental and social impacts associated with the production and use of Single Ply Roofing Membranes. Sustainability assessment standards inform and encourage the demand for and supply of products that cause less stress on the environment and society. The result is continuous market-driven improvement.

Standard 347 Overview

Based on life-cycle assessment principles, NSF/ANSI 347 employs an easy-to-use point system to evaluate roofing membrane products against established prerequisite requirements, performance criteria and quantifiable metrics in five key areas:

1. Product Design
2. Product Manufacturing
3. Membrane Durability
4. Corporate Governance
5. Innovation



For example, Product Design criteria require a prerequisite of an environmental assessment program that considers environmental attributes and impacts of products and packaging across the entire product life cycle (e.g., raw material extraction, manufacturing, use, and end of life). Criteria examples in Product Manufacturing include environmental management systems, energy conservation, waste minimization, water conservation and greenhouse gas reductions. Certification is based on point totals to achieve a Conformance, Silver, Gold, or Platinum level.

Manufacturers certified by NSF are authorized to use the NSF Sustainability Certified Mark on their products and in their advertising. Monitoring and periodic reevaluation is required to maintain certification.

NSF International
789 N. Dixboro Road
Ann Arbor, MI 48105 USA
+1 (734) 476 2543
www.nsf.org

NSF/ANSI 347, “Sustainability Assessment for Single Ply Roof Membranes”

IgCC[®]

INTERNATIONAL
GREEN CONSTRUCTION CODE[®]

A Comprehensive Solution for High-Performance Buildings

A Member of the International Code Family[®]



2021

POWERED BY

ANSI/ASHRAE/ICC/USGBC/IES 189.1-2020
Standard for the Design of High-Performance
Green Buildings Except Low-Rise Residential Buildings



[Link](#)

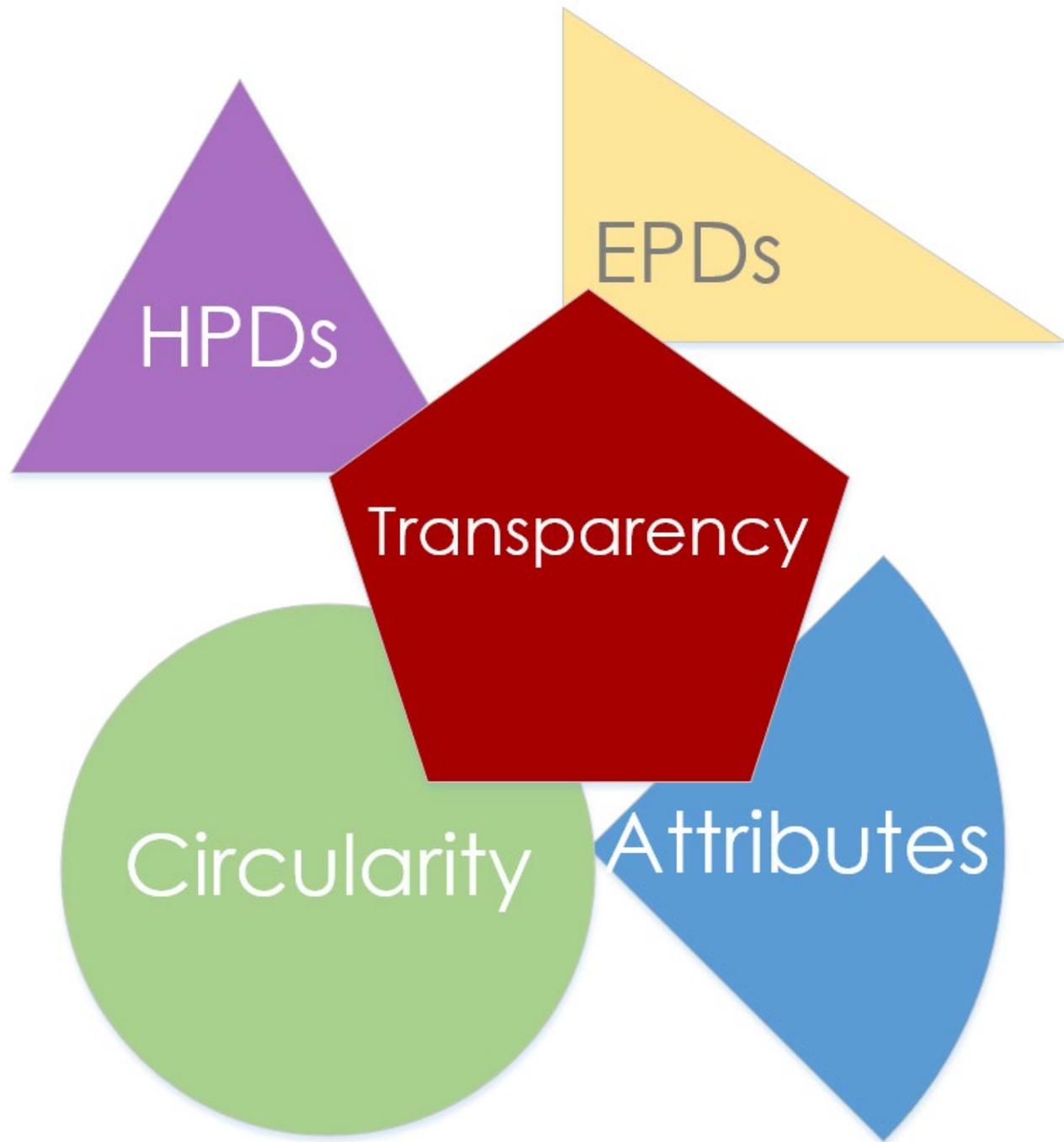
*International Green Construction
Code, 2021 Edition*

--ANSI/ASHRAE/ICC/USGBC/IES 189.1-2020

How Roofing Contributes

Certifications & Ratings

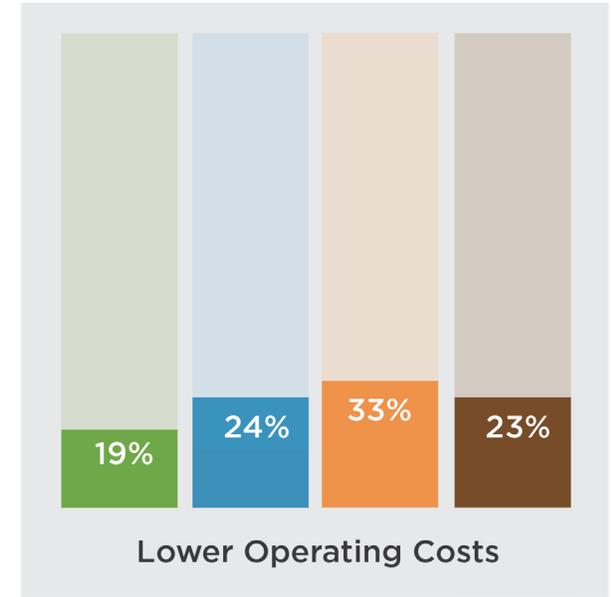
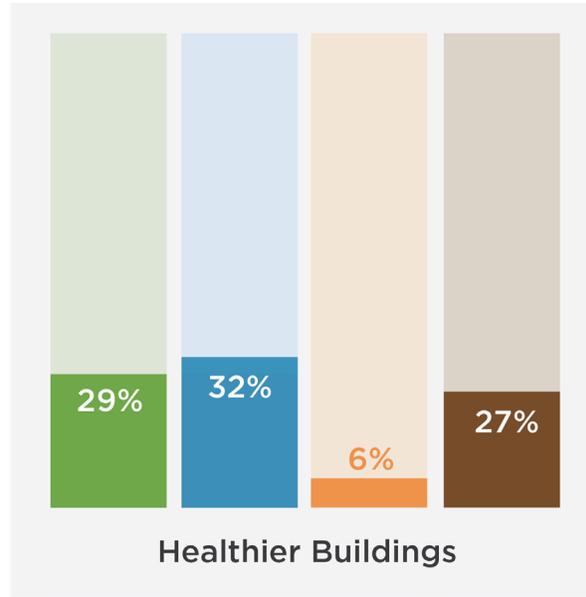
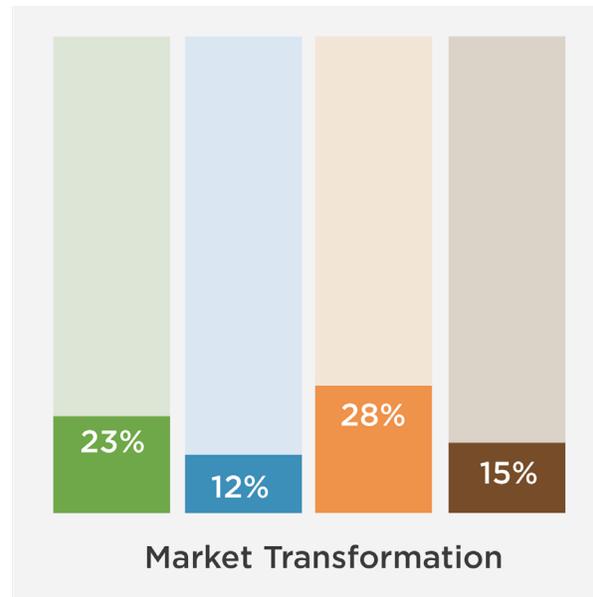
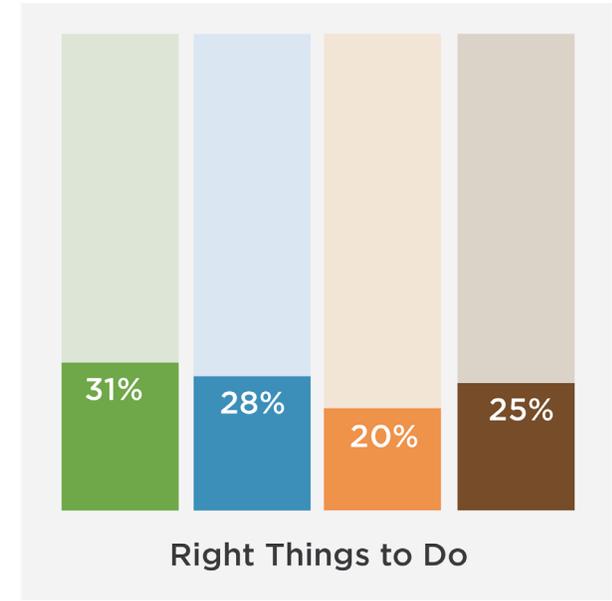
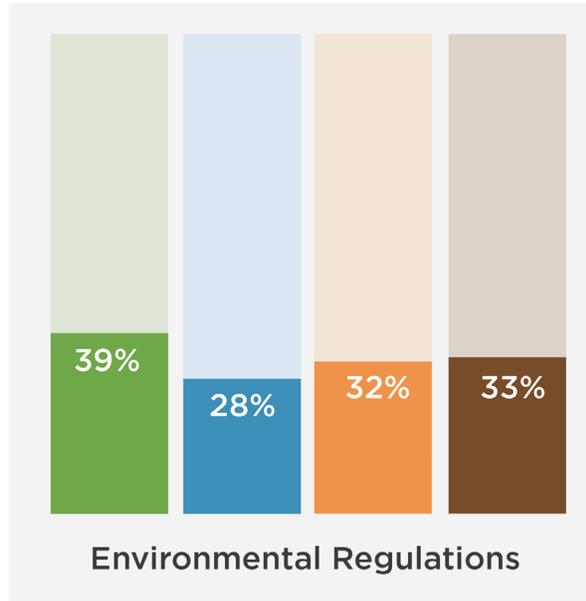
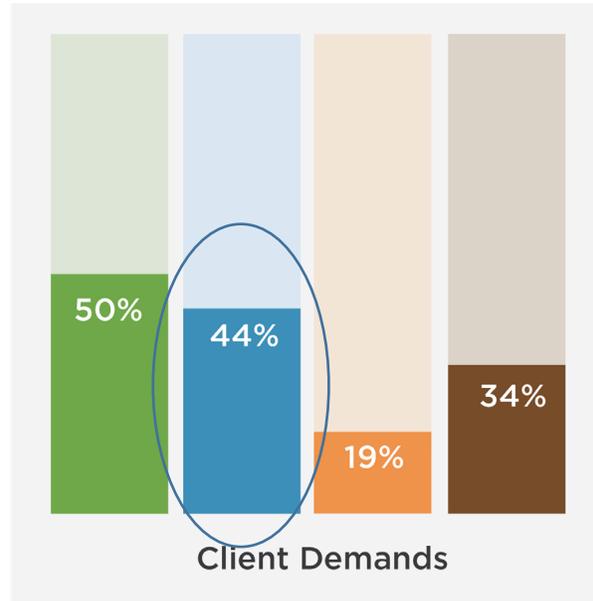




Drivers of the U.S. Green Building Market

Top Triggers Driving Future Building Activity in North America

Dodge Data & Analytics, 2018



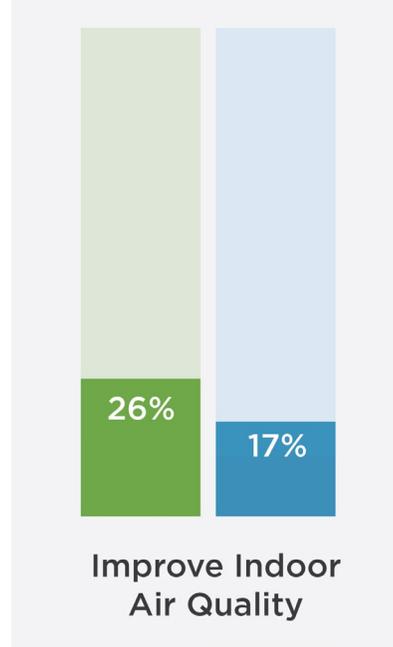
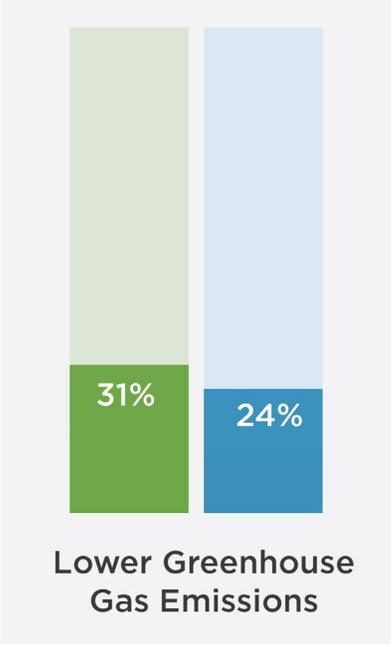
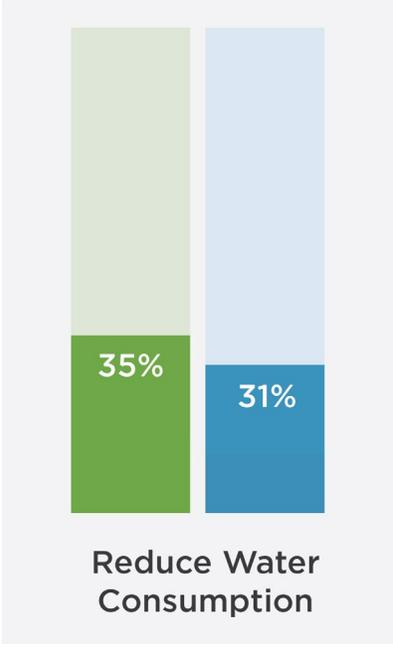
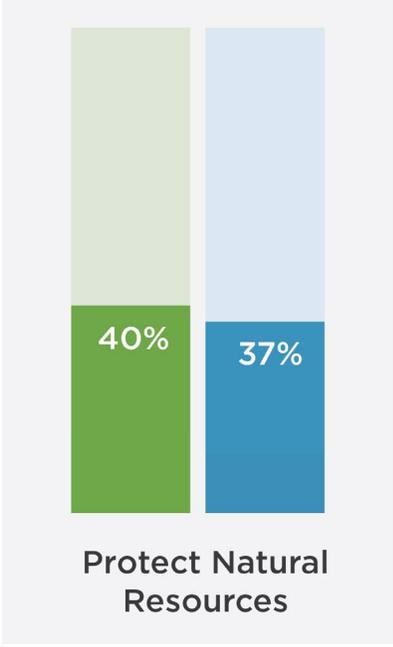
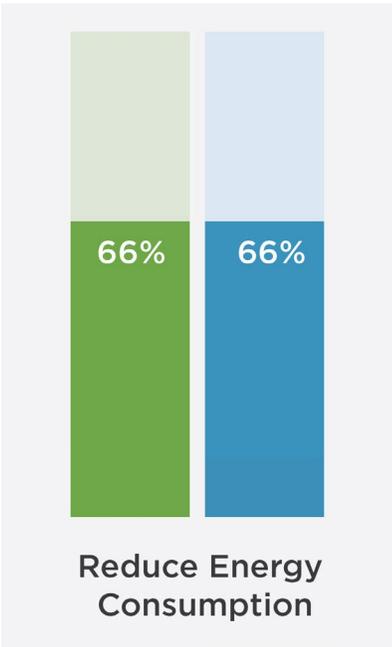
How Roofing Helps Achieve Green Building Energy Goals

Top Environmental Reasons for Building Green

(Ranked Among the Top Two Reasons by Those Who Consider it Important)

Since 2008, reducing energy consumption is still most frequently selected as a top environmental reason for building green.

2018 2015



Source: Dodge Data & Analytics, World Green Building Trends market report, 2018

Green Building Standards

“American communities have more options than ever for encouraging greener building and development. Many organizations have developed model codes or rating systems that communities can use to develop green building programs or revise building ordinances.”

- U.S. EPA

Major Options

- IgCC
- ASHRAE 189.1
- LEED
- Green Globes
- Living Building Challenge

Major Options

- IgCC
 - ASHRAE 189.1
- Model Codes
- LEED
 - Green Globes
 - Living Building Challenge
- Rating/Certification Systems

Rating/Certification Systems

- Generally voluntary
- New construction/existing buildings/additions
- All three include:
 - sustainable sites
 - energy efficiency
 - water efficiency
 - materials and resource use
 - indoor environmental quality

LEED LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN

To achieve LEED certification, a project earns points by adhering to prerequisites and credits that address carbon, energy, water, waste, transportation, materials, health and indoor environmental quality

More than 100,000 buildings participating today



Platinum

80+ points earned



Gold

60-79 points earned



Silver

50-59 points earned



Certified

40-49 points earned

How/Where Roofing Contributes in this space



LEED® v4 FOR BUILDING DESIGN AND CONSTRUCTION: NEW CONSTRUCTION

Sustainable Sites	Energy and Atmosphere		Materials and Resources				Indoor Environmental Quality
SSc5	EAp2/EAc2	EAc5	MRc2	MRc3	MRc4	MRp2/MRc5	EQc2
Heat Island Reduction	Min/Optimize Energy Performance	Renewable Energy Production	BPDO – Environmental Product Declarations (EPDs)	BPDO – Sourcing of Raw Materials (e.g., recycled content)	BPDO – Material Ingredients (e.g., HPDs)	Construction & Demo Waste Planning/Management	Low-Emitting Materials
Opt 1 & 2			Option 1	Option 2	Option 1	Opt 1 & 2	Opt 1 & 2

Green Globes

The certification program for commercial buildings provided by the Green Building Initiative (GBI)

Adapted in the US from Green Globes, a Canadian web-based tool with BREEAM Canada origins

Program is based on *ANSI/GBI -01-2019, American National Standard Green Globes Assessment Protocol for Commercial Buildings*

GBI also the provider for the Guiding Principles Compliance and third-party assessment program for federal building sustainability requirements

How/Where Roofing Contributes in this space

GREEN GLOBES® – NC v2013



Site	Materials and Resources	Energy		Indoor Environment
3.2.2.4	3.5.1.2	3.3.4.1	3.3.9.1	3.7.2.1
Heat Island Effect	Prescriptive Path for Building Core & Shell (e.g., EPDs)	Thermal Resistance	On-Site Renewable Energy	Volatile Organic Compounds (VOCs)
	Path B			

Living Building Challenge

One of a series of certifications offered by the International Living Futures Institute



LIVING BUILDING CHALLENGE™
LIVING CERTIFICATION



LIVING BUILDING CHALLENGE™
PETAL CERTIFICATION



CORE
GREEN BUILDING CERTIFICATION

Responding to climate change with holistic high performance.

Required Imperatives:

C1	01	Ecology of Place
C2	04	Human Scaled Living
C3	05	Responsible Water Use
C4	07	Energy + Carbon Reduction
C5	09	Healthy Interior Environment
C6	12	Responsible Materials
C7	17	Universal Access
C8	18	Inclusion
C9	19	Beauty + Biophilia
C10	20	Education + Inspiration

One pillar of deep regenerative design built on a holistic high-performance foundation.

All Core Imperatives are required, plus the remaining Imperatives to complete either the Water, or Energy or Materials Petal.

ALL CORE IMPERATIVES

Water

06	Net Positive Water
----	--------------------

Energy

08	Net Positive Carbon
----	---------------------

Materials

13	Red List
14	Responsible Sourcing
15	Living Economy Sourcing
16	Net Positive Waste

Summit of holistic aspiration and attainment; fully restorative.

All Imperatives must be achieved to certify:

01	Ecology of Place
02	Urban Agriculture
03	Habitat Exchange
04	Human Scaled Living
05	Responsible Water Use
06	Net Positive Water
07	Energy + Carbon Reduction
08	Net Positive Carbon
09	Healthy Interior Environment
10	Healthy Interior Performance
11	Access to Nature
12	Responsible Materials
13	Red List
14	Responsible Sourcing
15	Living Economy Sourcing
16	Net Positive Waste
17	Universal Access
18	Inclusion
19	Beauty + Biophilia
20	Education + Inspiration

How/Where Roofing Contributes in this space

LIVING BUILDING CHALLENGE™ v3.1



Health and Happiness Petal	Materials Petal			
108	110	112	113	114
Healthy Interior Environment (CDPH SM v1.1-2010)	Red List (Red List Free; VOCs; Disclosure)	Responsible Industry (Declare)	Living Economy Sourcing (Distance & Declare)	Net Positive Waste

And a Funny Thing Happens When You Consider “Roofing as a System”...



**LIVING
BUILDING
CHALLENGE™**

Materials Petal					
Net Positive Waste					

EPDM THERMOSET MEMBRANE ROOFING

Water Petal	Health + Happiness Petal	Materials Petal			
Net Positive Water	Healthy Interior Performance	Responsible Materials	Red List	Responsible Sourcing	Living Economy Sourcing

THERMAL INSULATION

Place Petal	Water Petal	Health + Happiness Petal	Beauty Petal
Urban Agriculture	Net Positive Water	Access To Nature	Education + Inspiration

VEGETATED ROOF SYSTEMS

Living Building Challenge Declare.

Nutrition labels for safe products

Declare is a platform to share and find healthy building products. Manufacturers voluntarily disclose product information on easy-to-read Declare labels, which are accessible on a free database

Declare.

TPO

Final Assembly: Multiple Locations in the USA

Life Expectancy: 20-30 Year(s)

End of Life Options: Salvageable/Reusable in its Entirety, Recyclable, Landfill

Ingredients:

Membrane: Ethylene/Propylene Copolymer; Magnesium hydroxide; 1,3-Propanediamin, N,N"-1,2-ethandiylobis-, Polymer mit 2,4,6-trichlor-1,3,5-triazin, Reaktionsprodukt mit N-butyl-2,2,6,6-tetramethyl-4-piperidinamin; Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, 2,2-bis[[3-[3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl]-1-oxopropoxy]methyl]-1,3-propanediyl ester; Calcium Stearate; Decanedioic acid, bis(2,2,6,6-tetramethyl-4-piperidinyl) ester; Docosanamide; Titanium dioxide; Tris(2,4-di-tert-butylphenyl) phosphite; **Scrim:** Polyethylene Terephthalate

Living Building Challenge Criteria: Compliant

I-13 Red List:

LBC Red List Free % Disclosed: 100% at 100ppm
 LBC Red List Approved VOC Content: Not Applicable
 Declared

I-10 Interior Performance: Not Applicable

I-14 Responsible Sourcing: Not Applicable

GAF-0008
EXP. 01 APR 2022
Original Issue Date: 2018

MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY
INTERNATIONAL LIVING FUTURE INSTITUTE™ living-future.org/declare

Living Building Challenge Declare.



Ingredients:

Membrane: Ethylene/Propylene Copolymer; Magnesium hydroxide; 1,3-Propandiamin, N,N''-1,2-ethandiylobis-, Polymer mit 2,4,6-trichlor-1,3-5-triazin, Reaktionsprodukt mit N-butyl-2,2,6,6-tetramethyl-4-piperidinamin; Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, 2,2-bis[[3-[3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl]-1-oxopropoxy]methyl]-1,3-propanediyl ester; Calcium Stearate; Decanedioic acid, bis(2,2,6,6-tetramethyl-4-piperidinyl) ester; Docosanamide; Titanium dioxide; Tris(2,4-di-tert-butylphenyl) phosphite; **Scrim:** Polyethylene Terephthalate

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LBC Red List Approved

Declared

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Red List Free

Red List Approved

% Disclosed: 100% at 100ppm

VOC Content: Not Applicable

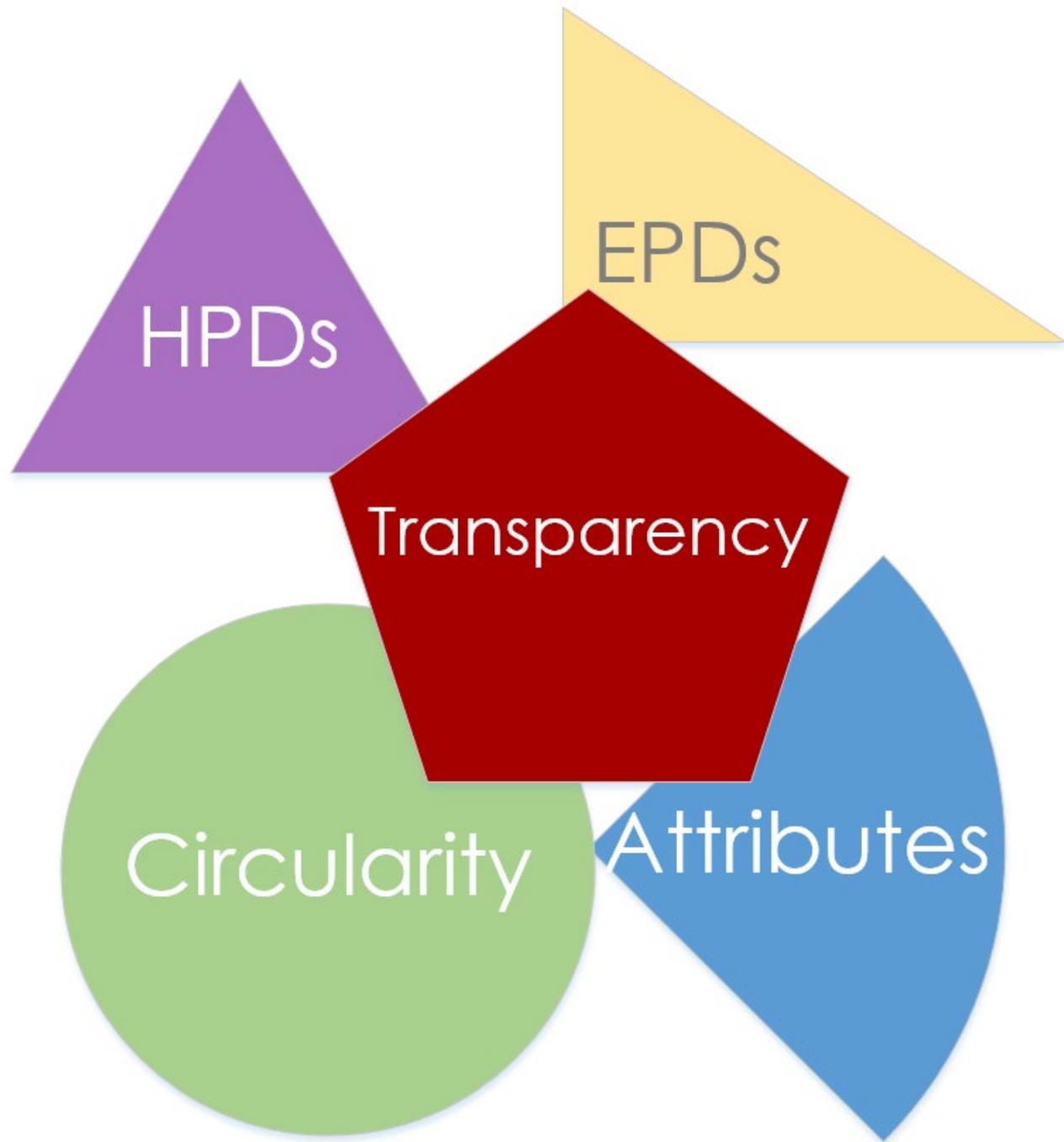
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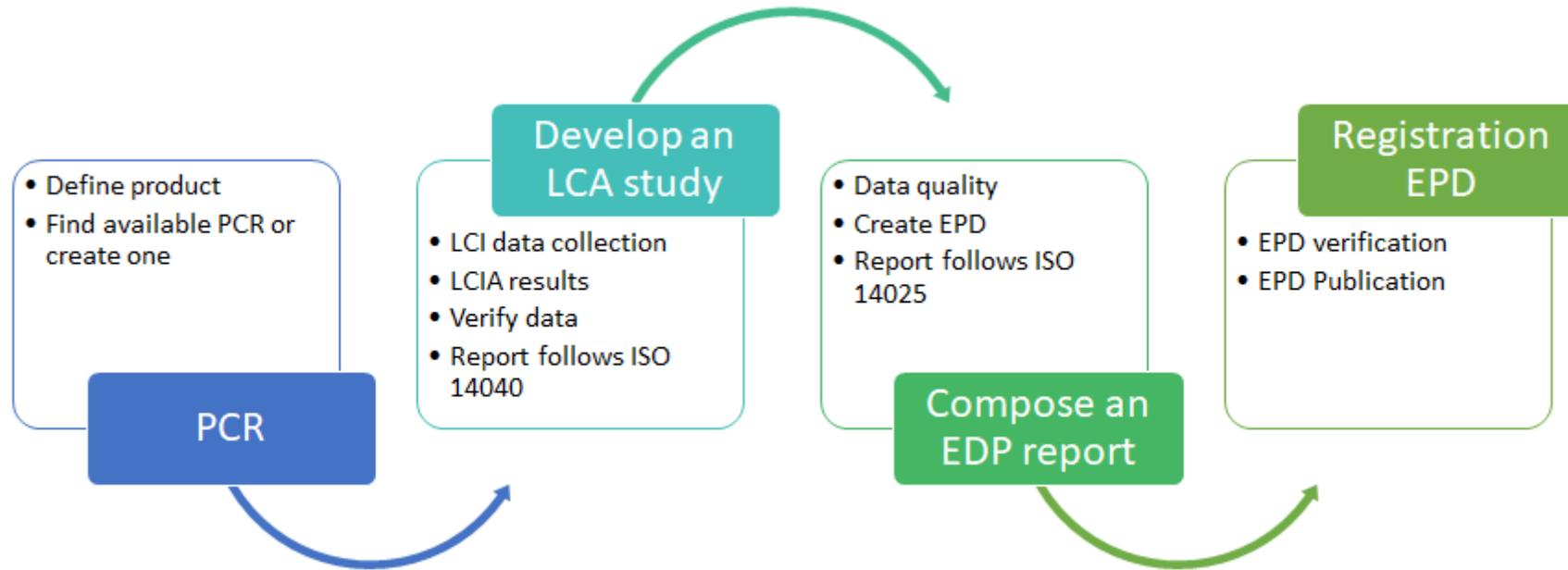
2022

Date: 2018

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What are the steps to produce an EPD



PCRs are the product category-specific requirements to prepare for an LCA

Life Cycle Analysis (LCA) collects data and prepares the results to publish in the Environmental Product Declaration.

Environmental Product Declarations (EPD), consistent with international standards ISO 14025 and ISO 14044 is then prepared for review. Once reviewed, it can be registered and published

EPD in simple terms

A comprehensive report that provides the life cycle story of a product.

Harvesting raw materials

Refining

Shipping

Manufacturing

Distribution

Installation

End of life events (i.e. upcycle, recycle or landfill)

EPDs in the Roofing Industry

Industry Associations such as ARMA, SPRI, and PIMA have collaborated with manufacturers to create industry wide EPDs.

ENVIRONMENTAL PRODUCT DECLARATION SBS-MODIFIED BITUMEN ROOFING MEMBRANE

INSTALLATION: COLD ADHESIVE



Low-slope roofing membrane installed using low-VOC adhesive and consisting of a SBS-modified bitumen cap sheet and base sheet.



The Asphalt Roofing Manufacturers Association (ARMA) is a trade association representing North America's asphalt roofing manufacturing companies and their raw material suppliers. The association includes the majority of North American manufacturers of asphalt shingles and asphalt low slope roof membrane systems. Information that ARMA gathers on modern asphalt roofing materials and practices is provided to building and code officials, as well as regulatory agencies and allied trade groups. Committed to advances in the asphalt roofing industry, ARMA is proud of the role it plays in promoting asphalt roofing to those in the building industry and to the public.

ARMA's vision and mission is to be an association committed to the long-term sustainability of the asphalt roofing industry and to advocate and advance the interests of the asphalt roofing industry by leveraging the collective expertise of its members.



Polyiso Roof Insulation Boards

For more than 30 years, the Polyisocyanurate Insulation Manufacturers Association (PIMA) has served as the voice of the North American rigid polyiso industry, and as a proactive advocate for safe, cost-effective, sustainable, and energy-efficient high-performance building construction. PIMA is one of the foremost industry advocates for building energy-efficiency practices and policies.

PIMA membership includes manufacturers of polyiso insulation products, raw material suppliers to the industry, and businesses that provide third-party testing services to manufacturers. PIMA members produce the majority of polyiso used in commercial roof and wall applications, and residential, institutional and industrial construction throughout the United States and Canada. PIMA represents the rigid polyiso industry in the development of product technical standards, certification programs, and energy efficiency advocacy.

As a leading advocate for building energy efficiency, PIMA has received many environmental awards, including the U.S. Environmental Protection Agency's Climate Protection Award in 2007 for the Association's leadership in promoting energy efficiency and climate protection. The U.S. EPA also awarded PIMA the Stratospheric Ozone Protection Award in 2002 for leadership in the CFC phase-out in polyiso insulation and in recognition of exceptional contributions to global environmental protection.

Date of Issue: November 4, 2020
Period of Validity: 5 years
Declaration Number: EPD10465



Certified
Environmental
Product Declaration
www.nsf.org

ENVIRONMENTAL PRODUCT DECLARATION TPO MEMBRANE

SINGLE PLY ROOFING MEMBRANE
INSTALLATION: MECHANICALLY FASTENED



Singly ply, TPO membrane mechanically fastened and representative of 45, 60, and 80 mil thicknesses



SPRI is the recognized technical and statistical authority on the Single Ply Roofing Industry. SPRI provides the best forum for its members to collectively focus their industry expertise and efforts on critical industry issues. By acting as a trade organization, as opposed to each member working individually, the group can effectively improve product quality, installation techniques, workforce training and other issues common to the industry. This approach enables every SPRI member to operate more effectively in the commercial roofing marketplace.

SPRI represents sheet membrane and related component suppliers in the commercial roofing industry. Since 1981, SPRI has been an excellent resource for building owners, architects, engineers, specifiers, contractors and maintenance personnel, providing objective information about commercial roofing components and systems.



EPD Information

ENVIRONMENTAL PRODUCT DECLARATION

According to ISO 14025 and ISO 21930:2017

NON-REINFORCED EPDM MEMBRANE

SINGLE PLY ROOFING INDUSTRY (SPRI)

Product

Industry EPD



About SPRI

SPRI is the recognized technical and statistical authority on the Single Ply Roofing Industry. SPRI provides the best forum for its members to collectively focus their industry expertise and efforts on critical industry issues. By acting as a trade organization, as opposed to each member working individually, the group can effectively improve product quality, installation techniques, workforce training and other issues common to the industry. This approach enables every SPRI member to operate more effectively in the commercial roofing marketplace.

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Issue Date: 21-07-2022

Valid Until: 21-07-2027

Declaration Number: ASTM-EPD335



EPD Information

According to ISO 14025 and ISO 21930:2017

ENVIRONMENTAL PRODUCT DECLARATION
Non-Reinforced EPDM Single Ply Roofing Membrane

DECLARATION INFORMATION

Declaration	
Program Operator: ASTM International Company: Single Ply Roofing Industry 465 Waverley Oaks Road, Suite 421 Waltham, MA 02452 Tel: (781) 647-7026 Email: info@spri.org	 www.astm.org
Product Information	Validity / Applicability
Product Name: Non-Reinforced EPDM Single Ply Roofing Membrane	Period of Validity: This declaration is valid for a period of 5 years from the date of publication.
Product Definition: Non-Reinforced ethylene propylene diene monomer (EPDM) Single Ply Roofing Membrane	
Declaration Type: Business-to-business (B2B)	Geographic Scope: North America
PCR Reference: <ul style="list-style-type: none">Core PCR: ISO 21930:2017 (ISO, 2017)Sub-category PCR: Product Category Rules for Single Ply Roofing Membranes (NSF International, 2019)	PCR Review was conducted by: <ul style="list-style-type: none">Thomas P. Gloria, Ph.D., Industrial Ecology ConsultantsBill Stough, Sustainable Research GroupJack Geibig, EcoForm
Product Application and/or Characteristics	
Single ply, non-reinforced EPDM membrane representative of 45, 60, and 90 mil thicknesses are used as a roofing protective layer for building applications.	
Content of the Declaration	
<ul style="list-style-type: none">Product definition and physical building-related dataDetails of raw materials and material originDescription of how the product is manufacturedLife Cycle Assessment resultsAdditional environmental information	
Verification	
Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:200	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external
This declaration and the rules on which this EPD is based have been examined by an independent verifier in accordance with ISO 14025.	
Limitations <i>The environmental impact results of EPDM products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the EPDM product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted. See Section 3.10 For additional EPD comparability guidelines. Environmental declarations from different programs (ISO 14025) may not be comparable.</i>	

Content of Declaration

- Product definition and physical building-related data
- Details of raw materials and material origin
- Description of how the product is manufactured
- Life Cycle Assessment results
- Additional environmental information

EPD Information



ENVIRONMENTAL PRODUCT DECLARATION

Non-Reinforced EPDM Single Ply Roofing Membrane

According to ISO 14025 and ISO 21930:2017

GENERAL INFORMATION

DESCRIPTION OF COMPANY/ORGANIZATION

The following SPRI members provided data for the product under study:



Carlisle Construction Materials
1285 Ritner Hwy
Carlisle, PA 17013
www.carlisleconstructionmaterials.com



Johns Marville
P. O. Box 5108717
17th Street
Denver, CO 80217-5108
www.jm.com



Firestone Building Products
200 4th Avenue South
Nashville, TN 37201
www.firestonebpco.com

PRODUCT DESCRIPTION

The product system evaluated in this report is a single ply non-reinforced EPDM roofing membrane at the finished nominal thicknesses produced by SPRI members. See Table 1 for membrane specification and standard.

Table 1 Membrane specification and standard

Roof System	Roof System Component	Declared Thicknesses and Weights	Standard
Non-Reinforced ethylene propylene diene monomer (EPDM)	Membrane	45 mils: 1.38 kg/m ² 60 mils: 1.81 kg/m ² 90 mils: 2.82 kg/m ²	ASTM D4637



Manufactures that participated in supplying data for EPD

EPD Information

METHODOLOGICAL FRAMEWORK

DECLARED UNIT

1 m² of single ply roofing membrane for a stated product thickness. Environmental performance results therefore represent the industry average production of EPDM, normalized to 1 m². The reference service life is not specified. Since the use stage is not included in the system boundary, no reference service life needs to be defined for the analysis.

SYSTEM BOUNDARY

System boundaries are summarized in Figure 2 for the analysis scope of "cradle-to-gate". Excluded modules are indicated by "MND" or "module not declared". As is typical of works of life cycle assessment, the construction and maintenance of capital equipment, such as production equipment in the manufacturing stage, are not included in the system, nor are human labor and employee commute. The use stage is also outside the scope of this study.

- Cradle-to-gate
- Raw material supply
 - Transport
 - Manufacturing

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 2 Life cycle stages included in system boundary

EPD Information

conservative assumptions regarding environmental impacts.

LIFE CYCLE ASSESSMENT RESULTS

The environmental impacts associated with the non-reinforced roofing membrane is presented below in Table 3 for production stage (A1-A3).

Table 3: Environmental impact indicators for 1m² of Non-Reinforced EPDM Single Ply Roofing Membrane

Indicator	A1	A2	A3	Total
Global Warming Potential [kg CO₂ eq.]				
EPDM (NR) 45 mils	3.59E+00	1.14E-01	1.03E+00	4.73E+00
EPDM (NR) 60 mils	4.69E+00	1.47E-01	1.30E+00	6.14E+00
EPDM (NR) 90 mils	7.33E+00	2.31E-01	2.00E+00	9.56E+00
Ozone Depletion Potential [kg CFC-11 eq.]				
EPDM (NR) 45 mils	4.19E-15	2.22E-17	7.99E-13	8.02E-13
EPDM (NR) 60 mils	5.46E-15	2.89E-17	1.10E-12	1.11E-12
EPDM (NR) 90 mils	8.53E-15	4.53E-17	1.73E-12	1.73E-12
Acidification Potential [Mole of H⁺ eq.]				
EPDM (NR) 45 mils	5.82E-03	1.01E-03	9.50E-04	7.76E-03
EPDM (NR) 60 mils	7.59E-03	1.23E-03	1.24E-03	1.00E-02
EPDM (NR) 90 mils	1.19E-02	1.91E-03	1.91E-03	1.57E-02
Eutrophication Potential [kg P eq.]				
EPDM (NR) 45 mils	5.15E-04	6.33E-05	9.32E-05	6.71E-04
EPDM (NR) 60 mils	6.81E-04	8.03E-05	1.22E-04	8.83E-04
EPDM (NR) 90 mils	1.07E-03	1.26E-04	1.89E-04	1.38E-03
Photochemical ozone formation, human health [kg O₃ eq.]				
EPDM (NR) 45 mils	1.03E-01	2.29E-02	1.74E-02	1.43E-01
EPDM (NR) 60 mils	1.35E-01	2.83E-02	2.27E-02	1.86E-01
EPDM (NR) 90 mils	2.11E-01	4.42E-02	3.50E-02	2.90E-01

The resource use associated with the non-reinforced roofing membrane is presented below in Table 4 for the production stage (A1-A3).

Table 4: Resource use indicators for 1m² of Non-Reinforced EPDM Single Ply Roofing Membrane

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 2 Life cycle stages included in system boundary

- LCA Results for stages A1-A3
- With total LCA for the Product Stage.

Utilizing EPDs

- Transparency data on products
- Product comparisons
- Select the product that aligns with the goals and objectives that the system being designed for.
 - Examples:
 - Is the goal to have a more renewable product?
 - Is the goal to have the lowest global warming potential?

Nutrition Facts	
about 42 servings per container	
Serving size	1/4 cup (27g)
Amount per serving	
Calories	130
% Daily Value*	
Total Fat 5g	6%
Saturated Fat 1.5g	8%
<i>Trans Fat</i> 0g	
Cholesterol 0mg	0%
Sodium 90mg	4%
Total Carbohydrate 20g	7%
Dietary Fiber less than 1g	2%
Total Sugars 11g	
Includes 11g Added Sugars	22%
Protein 1g	
Vitamin D 0mcg	0%
Calcium 10mg	0%
Iron 1.1mg	6%
Potassium 40mg	0%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



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