



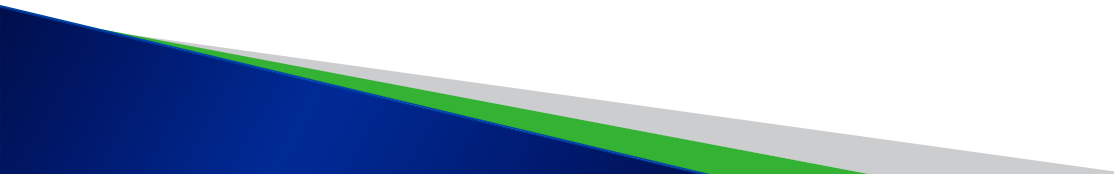
NSF/ANSI 347

THE ARCHITECT'S GUIDE TO SPECIFYING
SUSTAINABLE SINGLE-PLY ROOFING MEMBRANES

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Learning Objectives



After this presentation, you should be able to:

- Explain the evolution of standards and rating systems from single-attribute to multi-attribute certifications
- Describe NSF/ANSI 347: Sustainability Assessment for Single-Ply Roofing Membranes
- Define the key areas measured by the NSF/ANSI 347 standard
- Discuss how architects and specifiers can use NSF/ANSI to achieve their sustainability goals

Course Summary

Until recently, specifying a sustainable roofing membrane was a tricky business. Lacking a comprehensive, multi-attribute and certifiable assessment of the product, architects and specifiers had to decide which single attribute fit into their sustainability goals:

- Was it the roofing membrane's durability that mattered most?
- Or its potential to handle long-term heat exposure?
- Or its long-term maintenance and repairability?
- Or its lack of VOCs?
- Or did the packaging matter most?

Today, all those attributes are contained in one internationally recognized certification:

NSF/ANSI 347: SUSTAINABILITY ASSESSMENT FOR SINGLE-PLY ROOFING MEMBRANES

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 PB (Polybutylenes) products. This US national standard was developed through a consensus-based public process by a multi-stakeholder group of manufacturers, suppliers, regulatory agencies, customers, and 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, end 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 Certified, 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. Dixie Road
Ann Arbor, MI 48106 USA
Tel: (734) 776-2000
www.nsf.org

NSF

Course Summary

NSF/ANSI 347: SUSTAINABILITY ASSESSMENT FOR SINGLE-PLY ROOFING MEMBRANES

The purpose of this educational unit is to explain the significance of the first sustainable certification assessment for single-ply roofing membrane materials, and discuss how a manufacturer earns a certification for a Compliant, Silver, Gold, or Platinum rating.

This understanding will give architects and specifiers more options to reach their sustainability goals.

NSF/ANSI 347

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NSF International
383 N. Zeeb Road
Ann Arbor, MI 48106 USA
+1 (734) 770-2000
www.nsf.org

Course Outline

1. Verifiable Sustainability: How We Got Here

2. How the NSF/ANSI 347 Standard Was Created

3. How Points Are Earned

4. Using NSF/ANSI 347 to Achieve Sustainability Goals

5. Conclusion and Questions

VERIFIABLE SUSTAINABILITY: HOW WE GOT HERE

SECTION 1



Evolution of the Green Building Movement: Milestones

- A vigorous green building movement began, with a back-to-the-earth mentality of yurts and berm homes and organic materials.



The Oil Embargo of 1973

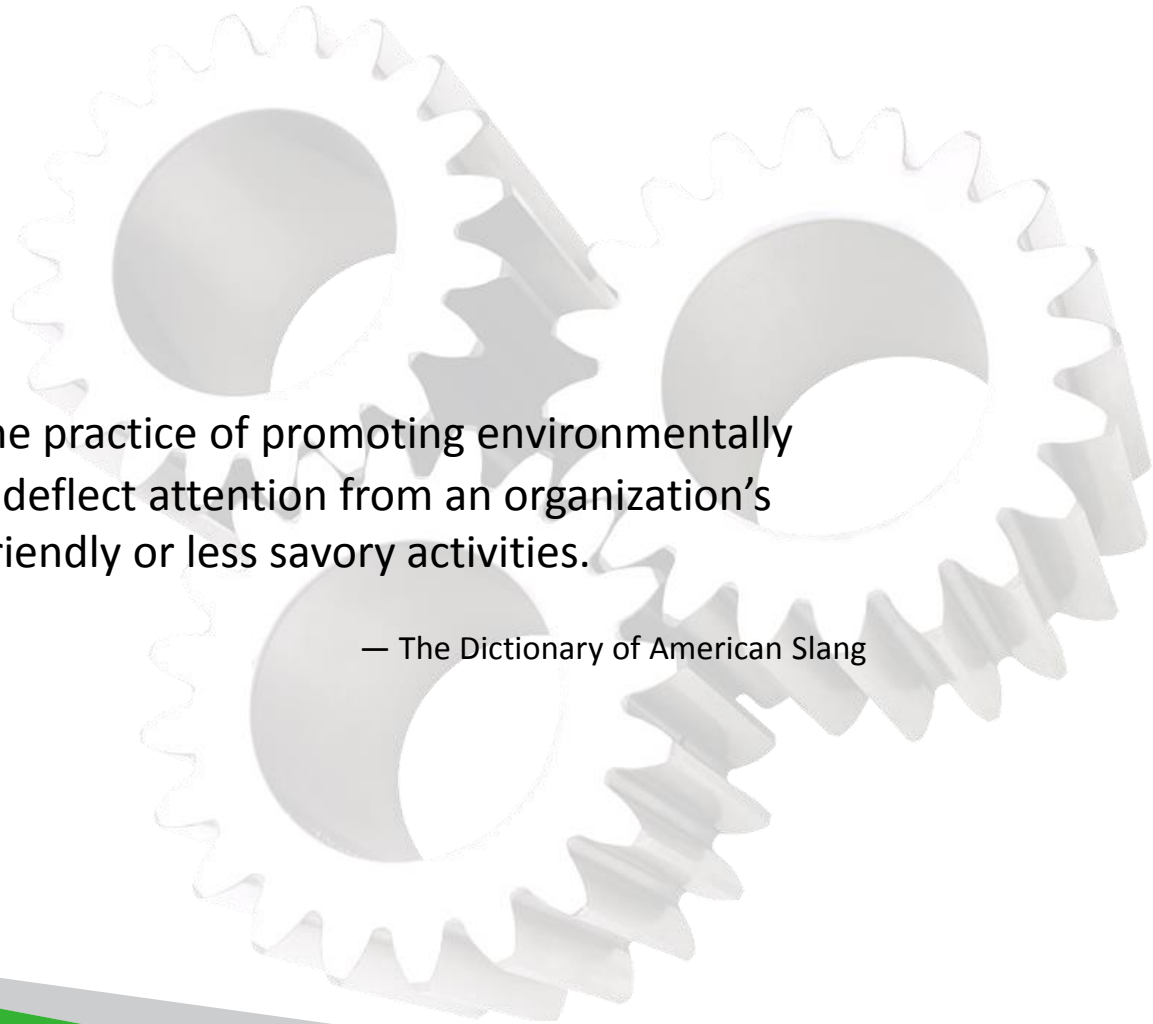


The Santa Barbara oil spill of 1969
(which spawned the first Earth Day)

'Lite' Green

Greenwash — The practice of promoting environmentally friendly programs to deflect attention from an organization's environmentally unfriendly or less savory activities.

— The Dictionary of American Slang



Verifiable Sustainability



- U.S. Green Building Council's LEED[®], Leadership in Energy and Environmental Design program
- Verifiable sustainability promoted by the American Institute of Architects
- Green Building Initiative's Green Globes[®] program

Beyond Single Attributes

CRADLE → GATE

CRADLE → GRAVE

CRADLE → CRADLE

- **Old Focus on Single Attributes:**
 - Low VOC
 - Energy saving
 - Recyclable
- **New Focus on Life Cycle:**
 - What is the story of this product during its life cycle, from cradle to gate, cradle to grave, or cradle to cradle?

Life-Cycle Assessment and Multi-Attribute Certifications

“Today’s emphasis on green measurement systems and labels has led to a proliferation of unsubstantiated product marketing claims....The availability of verified EPDs helps architects, roofing consultants, contractors, and owners accurately assess a product’s impact on the environment.”

— Stanley Graveline, who sits on the technical committee of the CFFA, Chemical Fabrics and Film Association – Vinyl Roofing Division

ENVIRONMENTAL PRODUCT DECLARATION

COMPANY NAME

| Raw Material Input | 40-mil | 50-mil | 60-mil |
|--------------------------------------|---------------------|-------------|-------------|
| | % weight of product | | |
| Other materials | 3% | 3% | 3% |
| Ethylene Phosphazene, 10, 10'-oxydi- | 0.1% | 0.4% | 0.4% |
| Total | 100% | 100% | 100% |

Table 3: Packaging materials for 1m² of 40-mil, 50-mil, and 60-mil white Duo-Last membrane

| Packaging Material | Quantity (kg) |
|--------------------|---------------|
| Wooden pallet | 0.30 |
| Cardboard core | 0.08 |
| EPS roll guard | 0.02 |
| Plastic banding | 0.00 |
| Total | 0.40 |

Life Cycle Assessment

Impact Categories and Assessment Methodologies

The life cycle impact assessment (LCIA) method used was the U.S. EPA TRACI 2.1 v1.015.1.S. 2008, as required by ASTM S3708 PCR: 2013. The S3708 PCR also requires the following resource use and waste indicators to be reported:

- Total primary energy consumption in MJ, renewable and non-renewables.
- Material resource consumption, renewable and non-renewable materials, and fresh water.
- Hazardous and non-hazardous waste generated.

The total primary energy consumption information was compiled by the Cumulative Energy Demand method. The material resource consumption and generated wastes were compiled by a custom method to represent cumulative life cycle inventory data.

Life Cycle Assessment Results

The LCA describes the potential environmental impacts based on the life cycle inventory. Table 4 details the cradle-to-gate LCA results from the three declared units, 40-mil, 50-mil, and 60-mil white PVC membrane.

| | 50-mil | 60-mil |
|-------------------|--------|--------|
| Weight of product | 40% | 41% |
| | 24% | 25% |
| | 19% | 16% |
| | 7% | 8% |
| | 4% | 4% |
| | 3% | 3% |

NSF Sustainability
Sustainability Assured

Date of Issue: January 15, 2015
Period of Validity: 5 years
Declaration: EPD1009

EPD Program Operator
NSF International, 780 N. Dixboro Rd.
Ann Arbor, MI 48105 USA
www.nsf-sustainability.org

Sample Pages of Environmental Product Declarations (EPD)

Trends in Multi-Attribute Standards

- Newest version of LEED rating system awards new Building Product Disclosure and Optimization credits for projects that include at least 20 building products with published EPDs.
- Green Building Initiative's Green Globes rating system provides a prescriptive path with reference to industry- wide or product-specific EPDs.
- The CFFA – Vinyl Roofing Division recently announced a new EPD for white, single-ply polyester-reinforced PVC roofing membrane.

Multiple attribute standards are a growing trend among industries like: roofing, resilient flooring, commercial furnishings, gypsum board, and flooring tiles.



HOW THE NSF/ANSI 347 STANDARD WAS CREATED

SECTION 2



Goal of NSF/ANSI 347: Quantify Roofing Membrane Sustainability

- Within roofing membrane industry, superior LCA is well known
- Goal is to quantify and document material's sustainable qualities
- Use of established scientific principles and standards



Multi-Year Development Process

STAKEHOLDERS

- Membrane manufacturers
- Architects and engineers
- Roofing industry consultants
- Trade associations
- National regulatory agencies
- Non-governmental organizations

Development of NSF/ANSI 347 Standard:

- Multi-year effort
- Large number of stakeholders
- Publicly transparent voting
- Through NSF's international consensus-based process
- And ANSI-accredited standard development process

Products in Scope of Standard



- Polyvinyl chloride (PVC)
- Thermoplastic polyolefin (TPO)
- Ethylene propylene diene terpolymer (EPDM)
- Ketone ethylene ester (KEE)
- Polyisobutylene (PIB) products

How NSF/ANSI 347 Certification is Achieved

PRODUCTS ARE RATED IN FIVE AREAS OF FOCUS

| | |
|-----------------------|-------------------|
| Product Design | 42 points |
| Product Manufacturing | 27 points |
| Membrane Durability | 40 points |
| Corporate Governance | 7 points |
| Innovation | 7 points |
| Total | 123 points |

Assessment Criteria for Earning Points



Product Design — 42 points

- Enlightened design process
- Environmentally sustainable material inputs
- Chemicals of concern
- Informed selection of suppliers Product recyclability into durable products
- Post-consumer single-ply roofing membrane reclamation
- Pre-consumer single-ply roofing membrane reclamation

Membrane Durability — 40 points

- Fitness of purpose
- Durability
- Membrane surface contribution
- Process based

Product Manufacturing — 27 points

- Environmental policy and management
- Conservation of energy resources
- Management of water resources
- Optimization of material resources
- Protection of air resources

Corporate Governance — 7 points

- General public disclosures
- Employer/employee responsibility
- Roofing contractor installation training
- Design professional outreach and education
- Standards and code organizations participation
- Community responsibility

Innovation — 7 points

- General criteria

Levels to Reach

- Compliant** Minimum 35 points
- Silver** Minimum 45 points
- Gold** Minimum 56 points
- Platinum** Minimum 75 points



Rating Benefits for Manufacturers



- Environmental claims backed up by science and data
- Eliminates greenwashing
- Transparency

Prerequisites

- The membrane manufacturer must have a plan for making a sustainably preferable product
- The plan must be implemented early in the process, in the design stage
- Product developers and designers should be looking into environmental impacts of their proposed product across its entire life cycle, from raw material extraction to manufacturing, use, and end of life



How Points Are Earned for Certification

SECTION 3



Product Design — Where It All Begins

- To encourage membrane manufacturers to focus on environmental and life-cycle issues from the beginning, the point system starts at the stage of product design
- The standard refers to it as an “enlightened design process.” Once a manufacturer has achieved the prerequisite of planning, points are available for a wide variety of criteria, from source materials to chemicals used and all the way to reclamation.



Enlightened Design Process

Life-Cycle Assessment (LCA) — The Membrane from Cradle to Gate or Cradle to Grave

- If a membrane manufacturer can demonstrate that one of several materials assessments was done within five years of the product undergoing this assessment, a maximum of 8 points can be earned
- More points can be earned by participating in a cradle-to gate or cradle-to-grave ISO 14044 conforming LCA
- LCA should analyze the environmental impacts of the product for:
 - Global warming
 - Greenhouse gas loadings
 - Acidification
 - Ozone layer depletion
 - Photochemical smog formation
 - Eutrophication or nitrogen loading



Environment



Life expectancy is the biggest single driver in any LCA analysis and NSF 347 recognizes that and awards points for it.

Where Did It All Begin?

Environmentally Sustainable Source Materials

- Purpose — to make sure the membrane manufacturer is informed about the environmental implications of the material composition of its products and packaging
- Encourages the use of component materials from sustainable inputs, such as recycled materials and bio-based resources
- Emphasis on using recycled content, or content from a bio-based source
- Most emphasis on post-consumer recycled content, which is valued at 100% of its weight



Concern with Chemicals



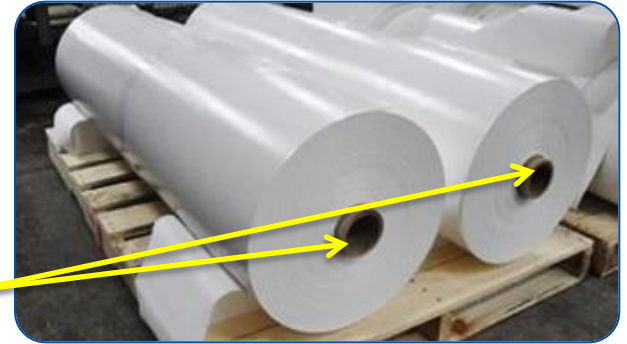
Not all chemicals are created equal, and not all chemicals are toxins and carcinogens.

- Purpose — to inform the manufacturer of the human health and ecological hazards associated with the product's raw materials
- Credits weighted heavier on the reduction and elimination credits to encourage use of environmentally compatible products and eliminate the use of chemicals with known hazards
- Manufacturer earns 1 point by creating a report evaluating its product formulation against the hazard lists
- Further eliminating or reducing the concentration of any known hazardous substance can earn up to another 5 points

Case Study: Sustainable Packaging Earns Points

- One company whose single-ply roofing membrane achieved a Gold rating in NSF /ANSI 347 standard uses cores that contain 100% recycled content
- The company also uses plastic banding that contains 100% recycled content, 60% of which is made from post-consumer recycled bottles

All packaging materials at this company are 100% recyclable.



Cores
100%
recycled
content

Case Study: Many Roads to Recycling

A company whose single-ply roofing membrane achieved a Gold rating in the NSF /ANSI 347 standard recycles manufacturing scrap in 3 different ways to support positive waste management practices:

1. Scrap recycled back into production
2. Leftover material reground to producing resilient commercial flooring
3. Pieces of membrane scrap used to make a line of prefabricated roof accessories



Causing an Impact Upstream — Informed Selection of Suppliers

- Does the supplier comply with local, regional and national environmental requirements?
- Does it have an environmental management system in place?
- Does it use renewable energy and track greenhouse gas emissions?
- Does the supplier have a social accountability disclosure process?



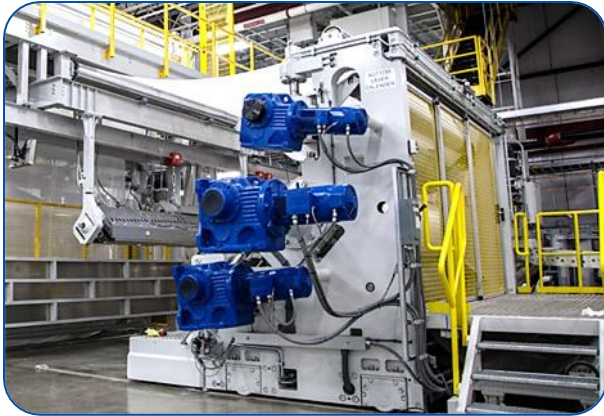
At the minimum, these thought-provoking point categories cause the membrane manufacturer to examine its own choice of suppliers, and to make choices based on these criteria.

Recycling and Reclaiming Roofing Membranes

- Points awarded for recycling post-consumer membranes into durable products with a documented 5-year or 10-year life expectancy
- Points awarded for achieving increasing annual performance targets when reclamation program includes:
 - Chain of custody
 - Tracking
 - A take-back process



In the Factory: The Roofing Membrane Manufacturing Process



- To earn the maximum of 6 points, the membrane manufacturer should create a formal Environmental Management System (EMS) that is specific to the manufacturing site
- The EMS should be audited annually
- The EMS should be registered with a qualified third party
- The intention is transparency and accountability
- A tracking system earns an extra point

Conserving Energy and Considering Energy Sources

- **Manufacturers earn points for:**
 - Reduced energy consumption
 - Transitioning from energy from non-renewable sources to renewables such as wind, solar, biogas, and geothermal

Note: Because of extra energy needed to implement new systems, those increased usages will not be included in the calculations for the initial 5 years those processes are put in place.



Water and Waste Worries

- **Manufacturers can earn points by:**
 - Providing an inventory of water used, and how it's used
 - Reducing that consumption
 - Using internal cooling loop processes to reduce water discharges
- When the wastewater reaches drinking water quality standards, more points are awarded

Membrane manufacturers can reduce what goes to the landfill, minimize packaging materials, and document a recycling or reclamation program for used pallets.



Greenhouse Gas Emissions



International Organization
for Standardization



WORLD
RESOURCES
INSTITUTE



wbcasd

- The manufacturer is encouraged to complete a baseline inventory of GHG emissions in accordance with:
 - ISO 14064
 - EPA standards
 - Protocols established by the World Resources Institute (WRI)
 - Protocols established by the World Business Council on Sustainable Development (WBCSD)
 - Or an equivalent standard
- Increasing points for reductions of 2%, 4% and 6%
- Points for participating in a GHG reporting program and annual inventory
- Transparency of environmental impacts is stressed and incentivized

Membrane Durability: How Long Will It Last?

Two prerequisites:

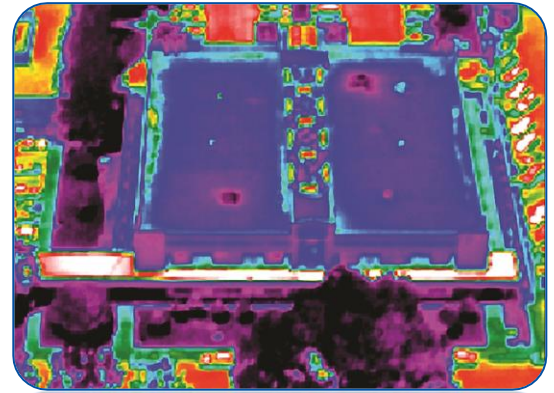
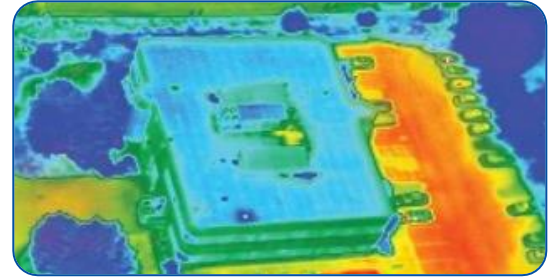
1. A documented installer-training program
 2. A post-inspection protocol in place and actively practiced
- For true sustainability, service life in the field is key
 - The NSF/ANSI 347 standard awards up to 12 points for membrane durability



Cool Roofs Mean Red Hot Savings

- White roofs known as “cool roofs” reflect light
- Reduce heat build up in the roofing material and the ultimate transfer of this heat into the building
- A light-colored, reflective roof surface reflects and drives solar heat away from the building and into the atmosphere
- A reflective roof system can:
 - Reduce building energy consumption
 - Improve insulation performance to reduce summer heat gain
 - Preserve the efficiency of rooftop air conditioning

A recent study showed that a cool roof can result in an average savings of more than \$1,000 annually in most climate zones for a typical commercial building.



The Overall Picture — Corporate Accountability to Social Issues

- Prerequisites include compliance with all applicable laws and regulations concerning:
 - Collective bargaining
 - Wage standards
 - Working conditions
 - Non-discrimination in employment
- Companies earn points for a published safety improvement manual, and annual reporting of accident and injury



Specifying an NSF/ANSI 347-certified roofing membrane is one way to ensure compliance with key corporate values.

Commitment to Community Investment

Prerequisite: Invest in communities in the form of grants and contributions within the communities where its products are manufactured and used.

Points earned for:

- Donations of roofing materials or reimbursement of roof installation labor costs for community projects throughout the country where they are manufactured
- Donations to service or other charitable organizations located within a 30-mile radius of any primary manufacturing or distribution facility
- Donations to non-profit organizations associated with the roofing industry
- Donations to roofing industry scholarship funds or direct scholarships for students in construction-related educational programs



Case Study: Commitment to the Community

A company whose membrane received NSF /ANSI 347 Gold certification achieved the community investment credits through multiple avenues:

- The company has strong roots within its community and donates a roof every year to a local church or school in need
- For instance, the company donated a roof for a new teaching hospital in Michigan
- The employees also are given the opportunity to volunteer for Habitat for Humanity
- In 2014 volunteers spent over 300 hours servicing the community



Throughout the year the employees of this company also raise money for a multitude of organizations such as:

The Angel Tree
Habitat for Humanity
Breast Cancer Awareness



Innovation Rewarded



Additional points available for:

- Increasing environmentally sustainable content
- Reduction of energy consumption
- Investment of capital in renewable energy at the manufacturing plant
- Reduced water consumption and minimization of waste materials

Using NSF/ANSI 347 to Achieve Sustainability Goals

SECTION 4



Market Demands



- Market demand for products that comply with green building standards has increased exponentially during the past decade
- The U.S. Green Building Council estimates that more than 3.6 billion sq. ft. of office space are certified by LEED rating program

Areas with the greatest per capital investment in green buildings in the U.S. for 2014 were:

- Washington D.C.
- Virginia
- Georgia
- Illinois
- Massachusetts
- Minnesota
- Colorado
- Hawaii
- Arizona
- Maryland
- California
- New York

Market Demands

- Based on statistics from McGraw Hill Construction (now Dodge Data & Analytics), USGBC estimates that 41% of all nonresidential building starts in 2012 were green, compared to 2% of all nonresidential building starts in 2005



LEED Rating System

- While LEED doesn't have a designated credit for multi-attribute sustainability standards, the due diligence to earn the NSF/ANSI 347 credits can help manufacturers get a head start on the required documentation for USGBC's latest LEED revision, version 4 (v4)
- The credits in NSF/ANSI 347 can help give the manufacturer a leg up on the new LEED v4 Material and Resources credits that require material chemistry disclosures and EPDs



Chemicals of Concern



- The chemicals of concern section of NSF/ANSI 347 help address the growing demand of material chemistry transparency, which is addressed in the Building Product Disclosure and Optimization – Material Ingredients credit
- To fulfill the Chemicals of Concern NSF/ANSI 347 credits, the manufacturer creates an ingredient inventory of the product to 0.1% (1000 ppm)
- This inventory can then be entered into an HPD that analyzes the chemical hazards against 23 "red lists" and complies with the LEED v4 credit

HPDs have been scrutinized by manufacturers and the chemical industry for only acknowledging chemical hazards and not focusing enough on risk.

Product Transparency Declaration



- The Resilient Floor Covering Institute (RFCI), created a material chemistry disclosure document called a Product Transparency Declaration (PTD)
- The format of a PTD is similar to an HPD except that the red lists have been reduced from 23 to six science-based, internationally recognized hazard lists, and include a section to address risk
- The PTD is now becoming an ASTM standard so it can be used by the greater manufacturing community
- Manufacturer can achieve the life cycle assessment credits where they complete a third-party verified product-specific EPD

In 2014, the single-ply PVC roofing industry, with the CFFA, published an industry-specific EPD for single-ply PVC membranes . That is the only industry EPD for single-ply roofing. The LEED v4 Building product Disclosure and Optimization - Environmental Product Declarations credit awards points for industry EPDs.

Green Globes



- NSF/ANSI 347 is an acceptable compliance path for the GBI's Green Globes building certification program
- Green Globes is a scientific, practical, and consensus-based standard
- New Green Globes for Commercial Buildings standard
- Major overhauls for Indoor Air Quality, Life Cycle Assessment, and Commissioning sections

Green Globes and LCA



- The Green Globes for New Construction standard, Material and Resources section, awards points if the project team conducts a whole-building life cycle assessment (LCA) using the Athena Impact Estimator for Buildings tool
- For those manufacturers whose product is not in the LCA tool, the credit's prescriptive path includes criteria for third-party verified multi-attribute certifications, like NSF/ANSI 347

International Green Construction Code

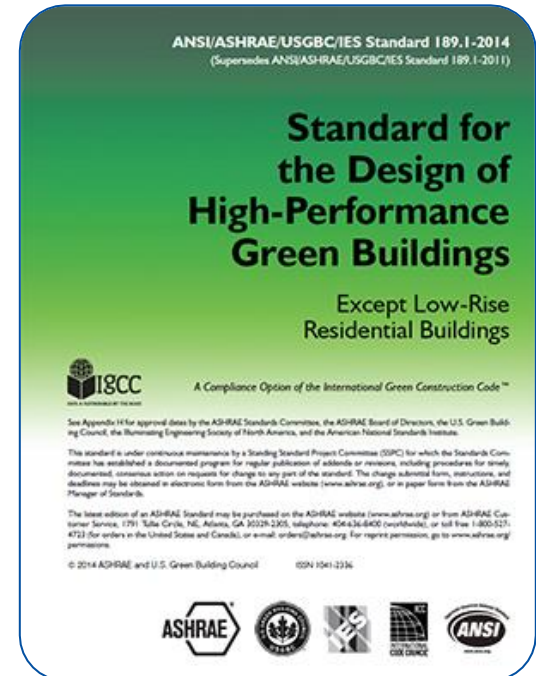


- First model code to include sustainability measures for the entire construction project and its site—from design through construction, certificate of occupancy and beyond
- Goals of 2015 version: to make buildings more efficient, reduce waste, and have a positive impact on health, safety and community welfare
- Language makes it easier to adopt and integrate into local and state municipality building codes
- IgCC 2012 adopted statewide by five municipalities, including Washington D.C., and four states have had local governments adopt the code

During the latest round of code hearings for the 2015 update, it was recommended to add NSF/ANSI 347 to the Material Resource Conservations and Efficiency section.

ANSI/ASHRAE/IES/USBGC Standard 189.1-2014

- ANSI, ASHRAE, the Illuminating Engineering Society of North America (IES) and USGBC announced a memorandum to collaborate on the development of Standard 189.1, IgCC, and LEED
- The goal is to “create a comprehensive framework for jurisdictions looking to implement and adopt green building regulations and codes and/or provide incentives for voluntary leadership programs such as LEED”
- Standard 189.1 already recognizes the importance of multi-attribute sustainability assessments by integrating NSF/ANSI 347 certification in its Atmosphere, Materials and Resources section



CONCLUSION



Conclusion

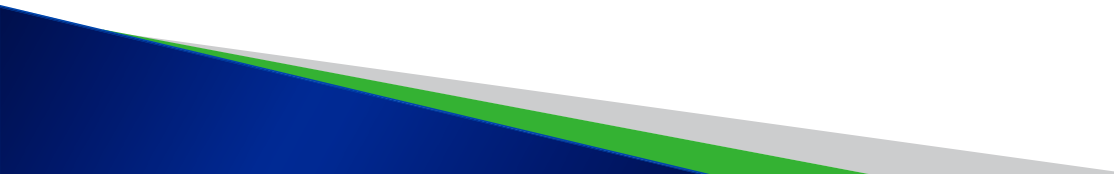
- While the standard, code or rating system for sustainable building materials may evolve over time, the drive toward sustainable practices will likely continue on a strong trajectory with increasing market share
- To prevent the watering down of both the science of sustainability and the perception of true and verifiable sustainability claims, more and more products will have strong third-party certifications
- Single-ply roofing membranes are now ahead of the green curve thanks to the NSF/ANSI 347 sustainability assessment

By paying attention to which roofing membranes have earned a compliant, silver, gold or platinum rating, architects and specifiers can be one step closer to achieving their sustainability goals.



Learning Objectives Review

Coming to the end of this presentation, you will be able to:

- Explain the evolution of standards and rating systems from single-attribute to multi-attribute certifications
 - Describe NSF/ANSI 347: Sustainability Assessment for Single-Ply Roofing Membranes
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- 

Thank You



Thank you for your time.

This concludes the AIA Continuing Education System Program.

Questions?

