Environmental Product Declarations (EPDs) for Asphalt Mixtures

What They Are and How To Use Them

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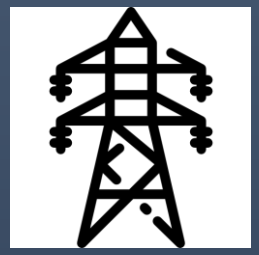
Vision: Sustainable communities and commerce, connected by net zero carbon emission asphalt pavements

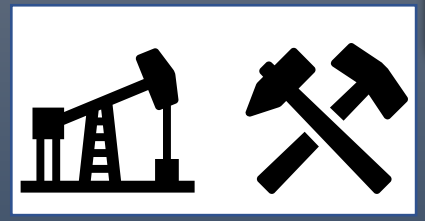
Mission: Engage, educate, and empower the U.S. asphalt community to produce and construct net zero carbon emission asphalt pavements

Production and Construction

Electricity



Net Zero Strategy



Supply Chain

Quality, Durability, Longevity, Efficiency

ENGAGE

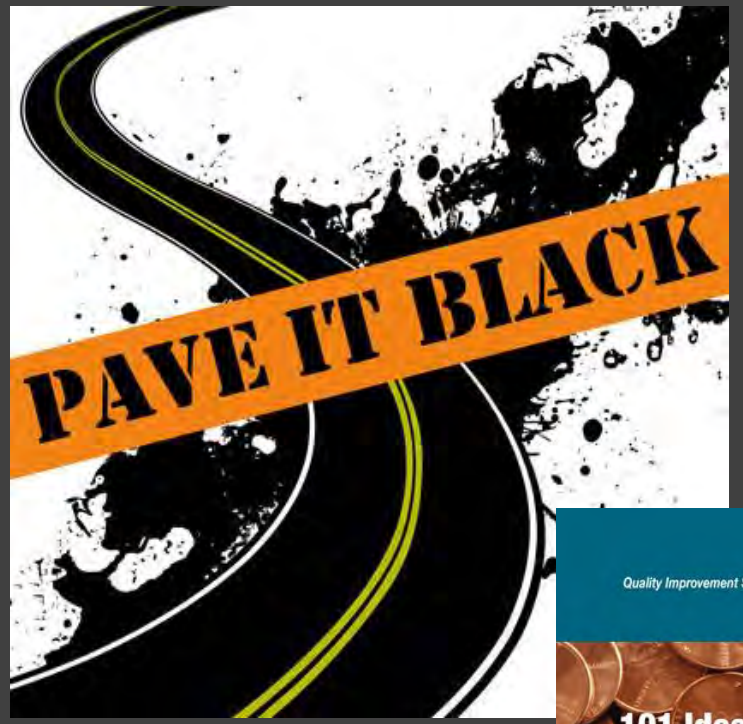

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

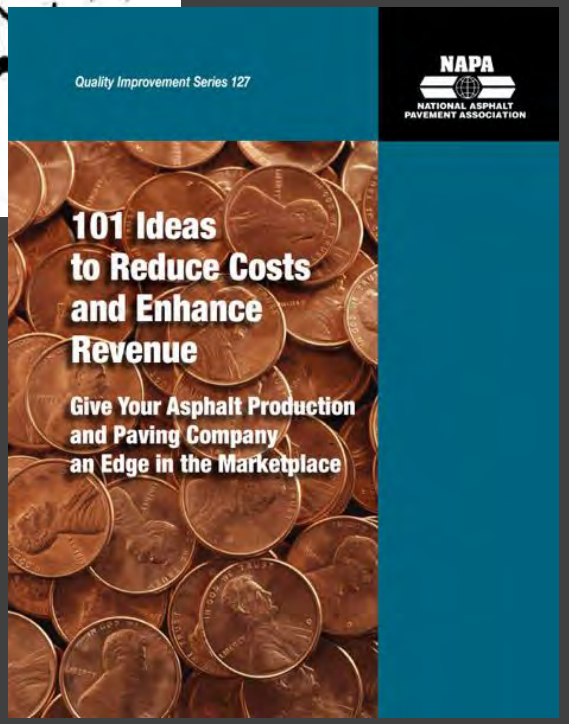

energy
ENERGY STAR
PARTNER


AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
TRANSPORTATION OFFICIALS
AASHTO
THE VOICE OF TRANSPORTATION

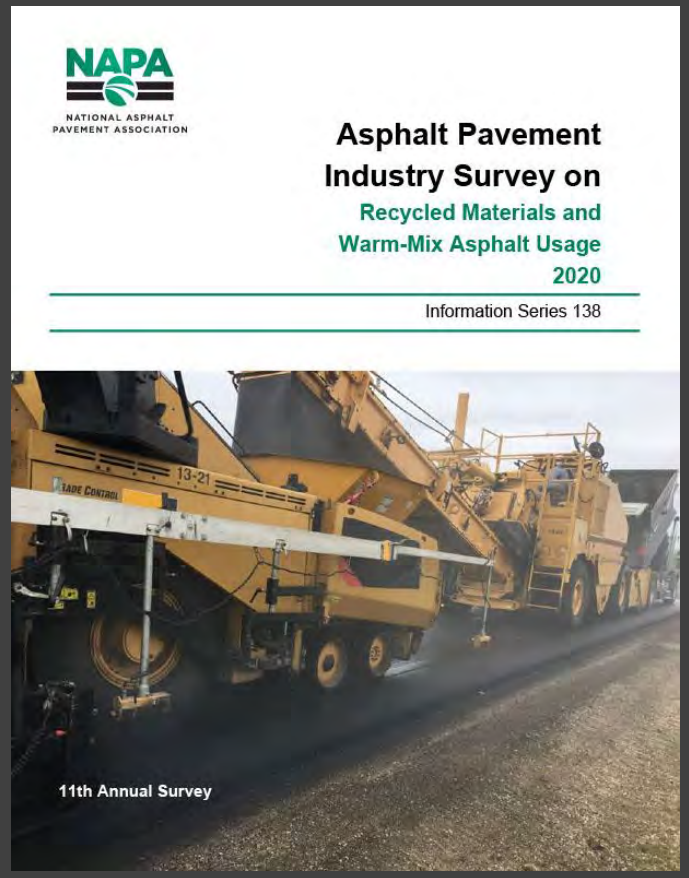
EDUCATE

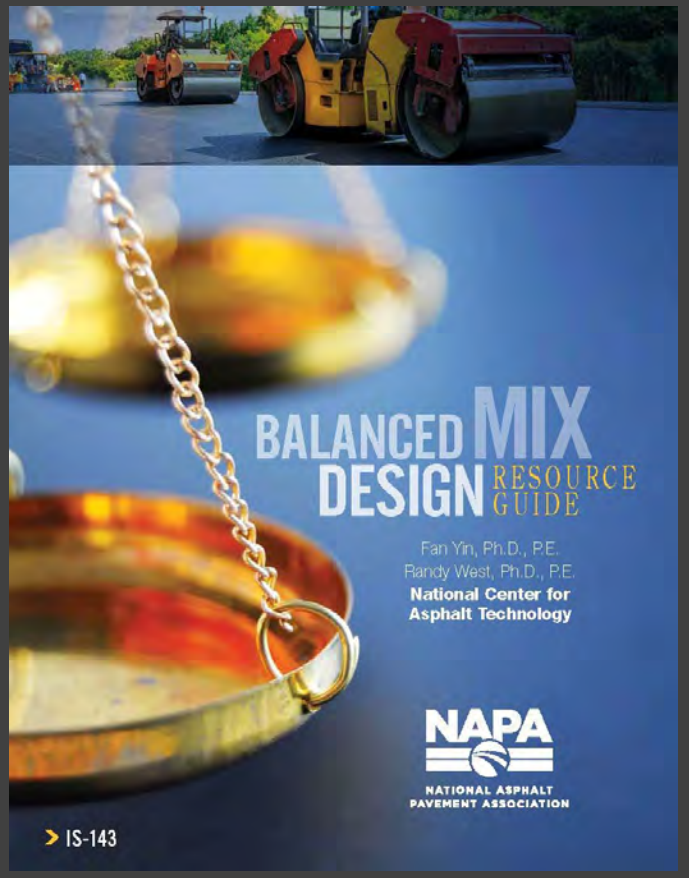
- Podcast Season 5
- Publications
- NAPA Webinar Series
  - May 2:
    Introducing the Road Forward
  - May 25:
    Results of the 2020 Recycled Materials Survey
  - June 6:
    Life Cycle Thinking

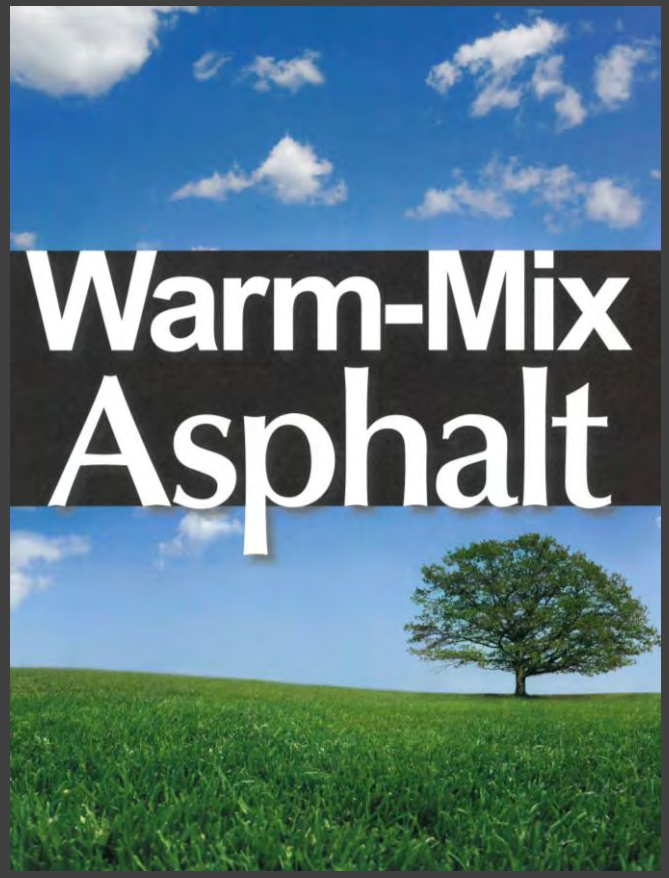




EMPOWER


NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION
Asphalt Pavement Industry Survey on
Recycled Materials and Warm-Mix Asphalt Usage 2020
Information Series 138
11th Annual Survey


BALANCED MIX DESIGN RESOURCE GUIDE
Fan Yin, Ph.D., P.E.
Randy West, Ph.D., P.E.
National Center for Asphalt Technology
NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION
IS-143


Warm-Mix Asphalt

PARTNER WITH NAPA

- Specific discussions at NAPA Committee meetings
  - Committee for Asphalt Research and Technology – April 25, 1 PM EDT
  - Committee for Engineering Application & Practice – May 2, 2 PM EDT
  - Sustainability Committee – May 5, 1 PM EDT

- NAPA is seeking Partners in this effort
  - AsphaltPavement.org/Climate/Partners

Introduction to EPDs

Understanding Carbon

Embodied Carbon

Manufacture, transport and installation of construction materials

Operational Carbon

Building Energy Consumption

https://www.architects.org/news/building-a-low-carbon-future-reducing-embodied-carbon-in-the-built-environment

What is an EPD?

- **Environmental Product Declaration**
  - **Quantified** environmental information on the **life cycle** of a product to enable **comparisons** between products fulfilling the **same function***

- **"Nutrition label" for environmental impacts**
  - Type III Environmental Label

- **Independently verified**

EPD "Nutrition" Label

Your Building Product

Amount per Unit

LCA IMACT MEASURES	TOTAL
Primary Energy (MJ)	12.4
Global Warming Potential (kg CO^2 eq)	0.96
Ozone Depletion (kg CFC 11 eq)	1.80E-08
Acidification Potential (mol H^+ eq)	0.03
Eutrophication Potential (kg N eq)	6.43E-04
Photo-Oxidant Creation Potential (kg O3 eq)	0.121

Your Product's Ingredients: Listed Here

https://westcoastclimateforum.com/cfpt/concrete/strategy1

*Source: ISO 14025:2006. **EPDs from different Product Categories should NOT be compared to each other.**

Types of EPDs

Industry-Wide


ENVIRONMENTAL PRODUCT DECLARATION

POLYPROPYLENE SIDING INDUSTRY AVERAGE

VINYL SIDING INSTITUTE

The Vinyl Siding Institute, Inc. (VSI) is the trade association for manufacturers of vinyl and other polymeric siding and suppliers to the industry. VSI focuses on factual data and science, like Life Cycle Assessment, to ensure true material understanding/evaluation and actual impact on the environment.

Led by VSI, the industry's commitment to sustainability has resulted in durable, long-life products that offer excellent overall environmental performance compared to other exterior cladding, with recognized environmental benefits to help make and keep homes green.

Polypropylene siding is produced in a variety of profiles, shapes, textures and colors.

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION

Product-Specific


bre

Statement of Verification

BREG EN EPD No.: 000390 Issue 1

This is to verify that the
Environmental Product Declaration
provided by:
Hempel A/S

BRE Global Verified EPD

is in accordance with the requirements of:
EN 15804:2012+A2:2019
and
BRE Global Scheme Document SD207

This declaration is for:
1 kilogram of Hempadur Fast Dry 17410 paint

Company Address

HEMPEL A/S
Lundtoftegårdsvej 91
DK-2800 Kgs. Lyngby
Denmark

HEMPEL

Emma Baker — Operator — 08 November 2021 — Date of this Issue

08 November 2021 — Date of First Issue — 07 November 2026 — Expiry Date

BRE Global Verified EPD

EPD

Plant-Specific & Product-Specific

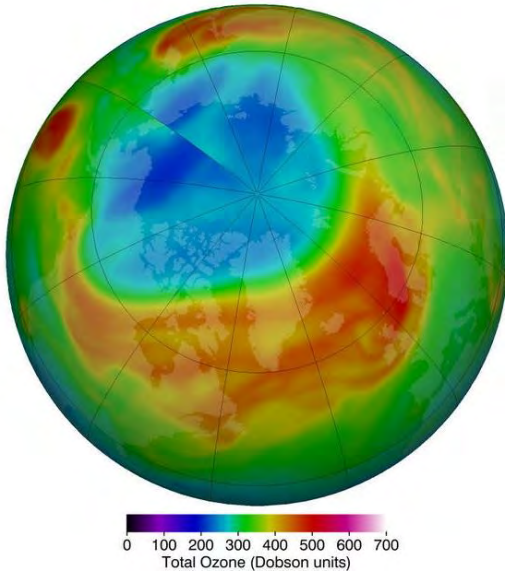
EPDs for Asphalt Mixtures are Plant-Specific & Product-Specific

Acidification Potential

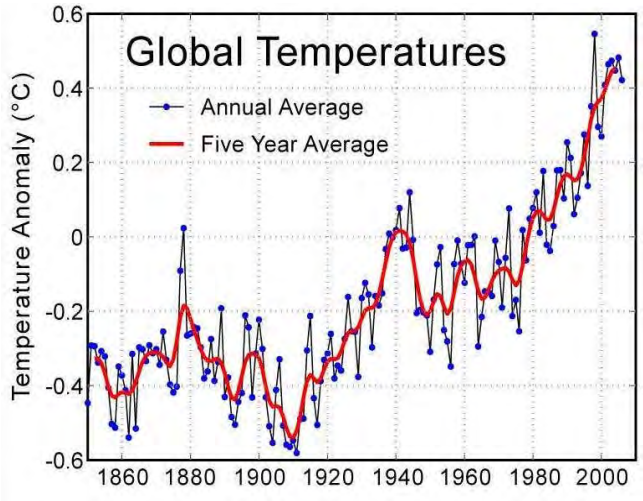
Recycled Materials Use

Smog Potential

Renewable Energy Use



Ozone Depletion Potential



Global Warming Potential

EPDs report a variety of potential environmental impacts and resource use indicators

(these are just a few examples)

How and Why are Pavement Owners Using EPDs?

LEED projects and other green rating systems

- **EPD credits included in LEED v4 and v4.1**
- **Disclosure credit**
  - Projects collect EPDs from 20 different products
- **1,000+** LEED v4 projects certified in 2020
  - Schools, banks, warehouses, medical, municipal, restaurants, etc.

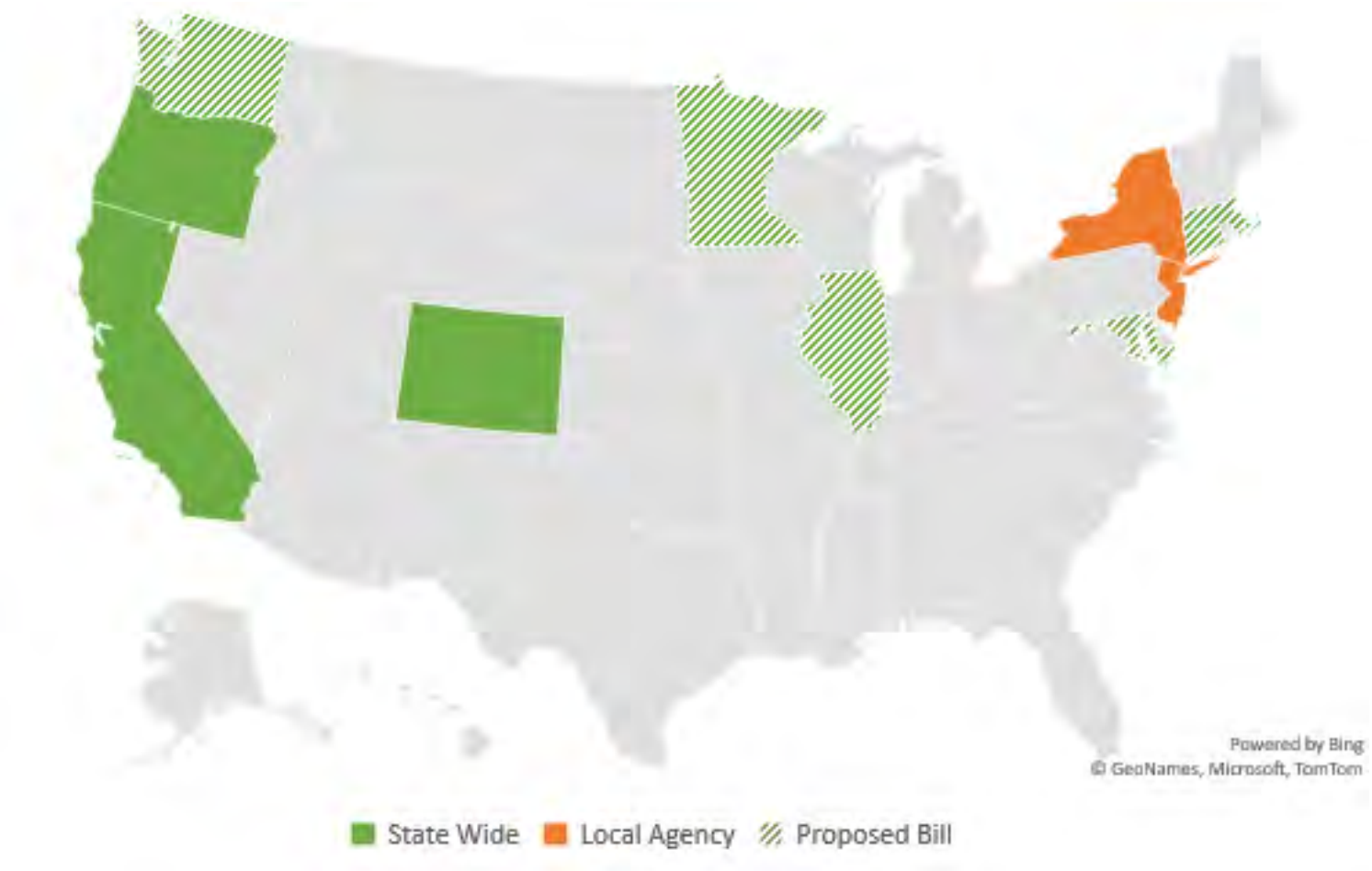
https://www.buildings.com/articles/27844/what-leed-gold-school-future-looks

“Buy Clean” Legislation

Jurisdictions with Buy Clean policies that include asphalt mixtures

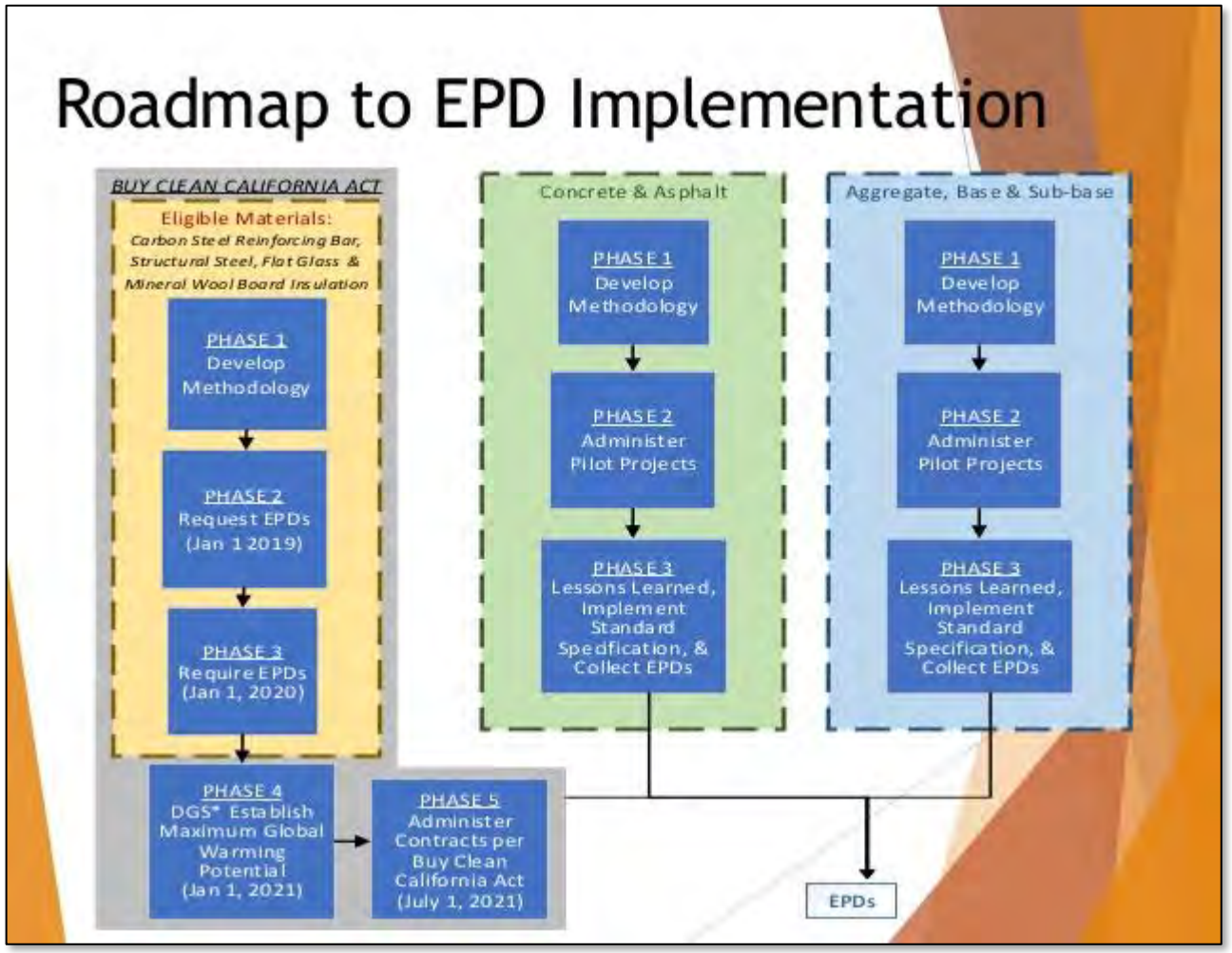
- Caltrans
- Colorado
- Oregon
- Port Authority of New York and New Jersey
- Illinois, Minnesota, other states are considering policies

- **Federal Govt. is establishing a Buy Clean Task Force**
  - GSA to pilot EPDs for projects funded by Infrastructure Act (IIJA)



Caltrans EPD Policy

- Policy decision by Caltrans to **get ahead of legislation**
- Contractors must submit EPDs for Concrete, **Asphalt**, and Aggregates
- Started with **7 projects** in 2019
- Targeted **20 projects** in 2021



https://www.slideshare.net/CaliforniaAsphalt/epd-implementation-on-caltrans-projects-137910238

HB 21-1303 – Buy Clean Colorado Act Implementation Timelines

Two Separate Policies

Vertical Construction Projects

- **2024** – State Architect establishes a **maximum GWP limit** for each type of material based on EPD
- **2026** – Review and revise maximum GWP limits

Roads and Highways

- **2022** – EPDs must be submitted to CDOT
- **2025** – CDOT establishes policy to **reduce GHG emissions**
- **2027** – CDOT policy reviewed and revised

Oregon EPD Bill (HB 4139)

- **Collect and analyze EPDs**
- **Conduct LCAs**
- **Devise strategies to reduce GHG**
- **Identify challenges & limitations**
- **All in coordination with a Technical Advisory Committee**

https://www.planetware.com/oregon/from-portland-to-mount-hood-best-ways-to-get-there-us-or-88.htm

GSA Environmentally Preferable Asphalt Standards

- P100 Facilities Standards (mandatory)
- Federal office buildings, courthouses, and land ports of entry
- Revised March 29, 2022

The [prime contractor] shall provide a product-specific cradle-to-gate Type III environmental product declaration (EPD) for each asphalt mix specified in the design and used at the project, using version 2 of the National Asphalt Paving Association's product category rule for asphalt mixtures. Please send EPD(s) to embodiedcarbon@gsa.gov, and upload EPD(s) into GSA's project management information system.

https://www.gsa.gov/real-estate/design-construction/engineering-and-architecture/facilities-standards-p100-overview

Infrastructure Bill

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION: Policy on Using Bipartisan Infrastructure Law Resources to Build a Better America**

Date: December 16, 2021

From: Stephanie Pollack
Deputy Administrator

In Reply Refer To:
HPL-1 and HCC-1

(2) new programs (some formula, some discretionary grants and some a combination of the two) such as the Bridge Investment Program, National EV Charging Program, Carbon Reduction Program and PROTECT program.

FHWA will issue guidance and regulations, as appropriate, to fully implement these legislative changes and new programs and is actively soliciting stakeholder input on these matters through a just-opened Federal Register docket.

Investments and projects that align with the BIL and will help Build a Better America include those that:

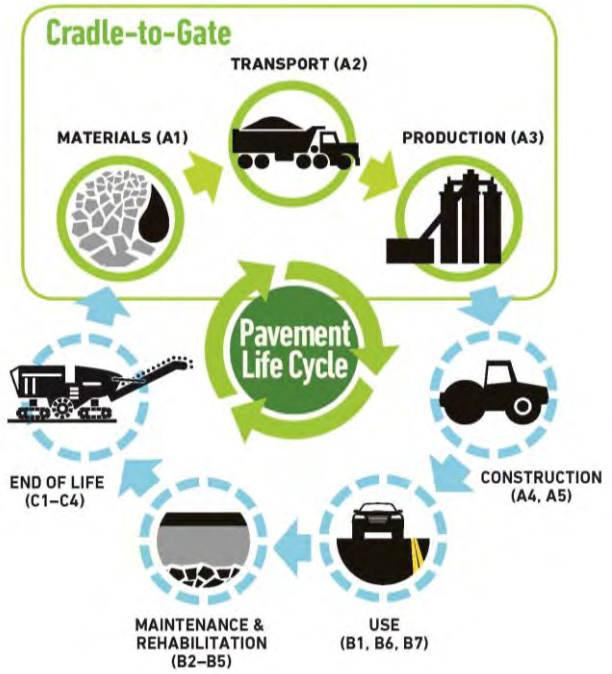
- improve the condition, resilience and safety of road and bridge assets consistent with asset management plans (including investing in preservation of those assets);
- promote and improve safety for all road users, particularly vulnerable users;
- make streets and other transportation facilities accessible to all users and compliant with the Americans with Disabilities Act;
- address environmental impacts ranging from stormwater runoff to greenhouse gas emissions;
- prioritize infrastructure that is less vulnerable and more resilient to a changing climate;

- Infrastructure grants will be tied to **climate change** and other **environmental priorities (EJ)**

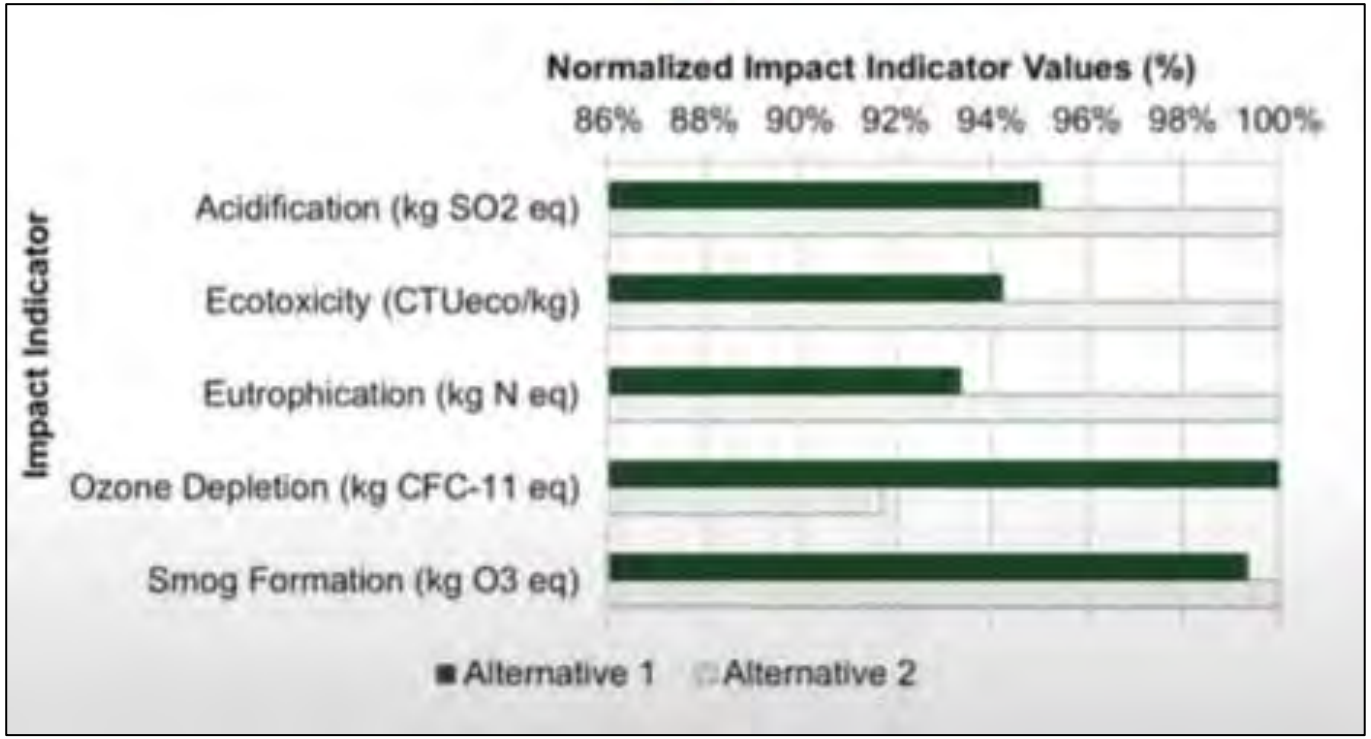
https://www.fhwa.dot.gov/bipartisan-infrastructure-law/building_a_better_america-policy_framework.cfm

FHWA Initiatives

- **LCA-Pave Software Tool**
  - Excel-based LCA software designed for agencies
  - Can use EPDs as a data input



LCA PAVE



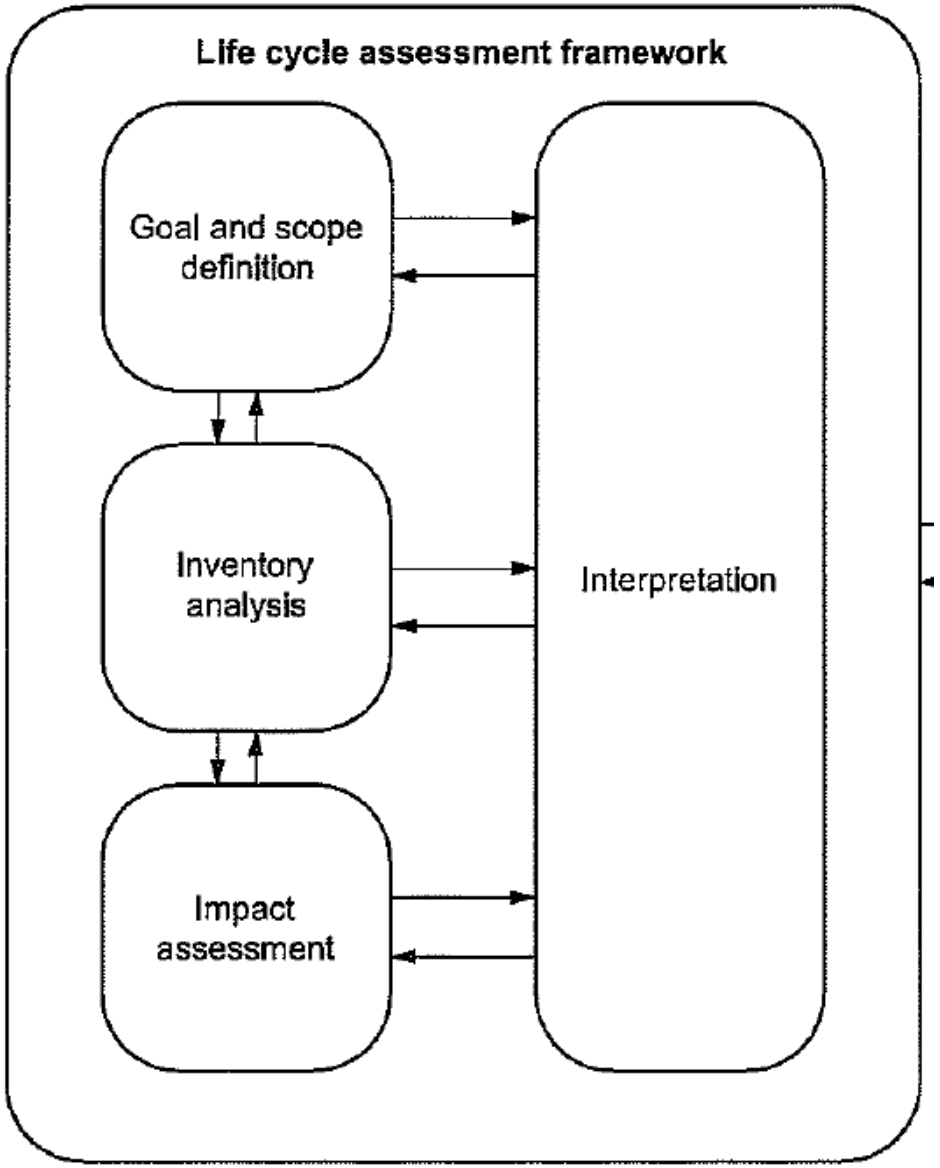
https://www.fhwa.dot.gov/pavement/lcatool/

EPD Framework and Standards

What is a Life Cycle Assessment (LCA)?

- Compilation and evaluation of **inputs**, **outputs**, and **potential environmental impacts** of a product system throughout its life cycle*

- Four phases
  - Goal and scope definition
  - Inventory analysis
  - Impact assessment
  - Interpretation



*Source: ISO 14040:2006

What is LCA used for?

- Identify areas to **improve environmental performance** (hot spot analysis)
- Inform strategic planning, priority setting, product or process design or redesign
- Select relevant indicators of environmental performance
- Marketing – to support environmental claims and develop **EPDs**

*Source: ISO 14040:2006

What is a PCR? (Product Category Rules)

- Set of specific **rules**, **requirements**, and **guidelines** for developing EPDs
  - How to conduct the LCA
- Defines what information should be disclosed to the public
- Developed by a **committee** that consists of:
  - Industry experts
  - LCA practitioners
- Designed to support **comparisons between products** and allow EPD users to understand the **limitations of comparability**

*Source: ISO 14025:2006

Existing Pavement Material PCRs

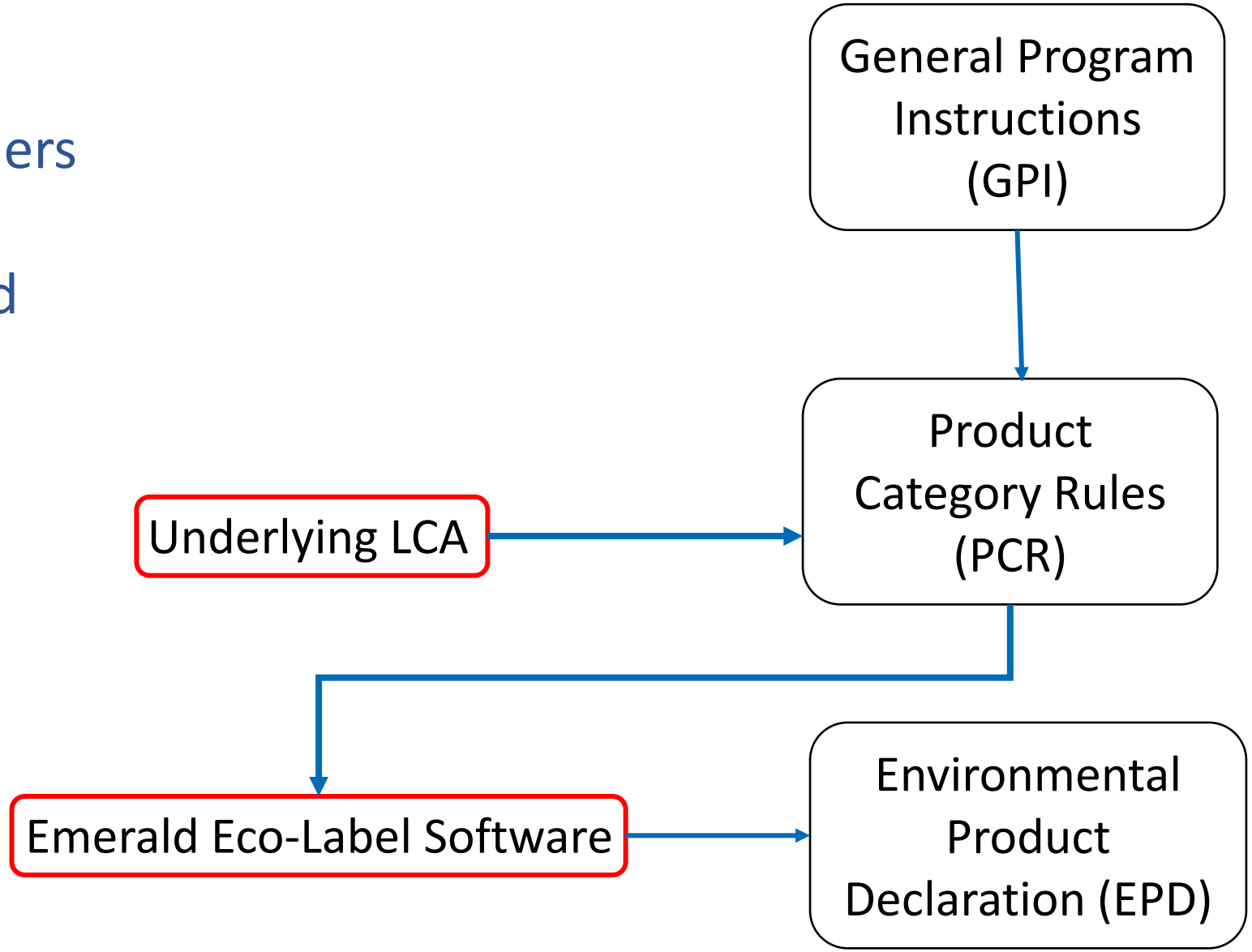
Past

Future

Material	Program Operator
Asphalt Mixtures	NAPA
Concrete	NSF International
Concrete Masonry & Segmental Concrete Paving Products	UL Environment
Construction Aggregates: Natural Aggregate, Crushed Concrete, and Iron/Steel Furnace Slag	NSF International
Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements	NSF International
Slag Cement	NSF International

EPD Program – Key Elements

- Multiple Stakeholders
- Consensus-Based
- Third-Party Verified



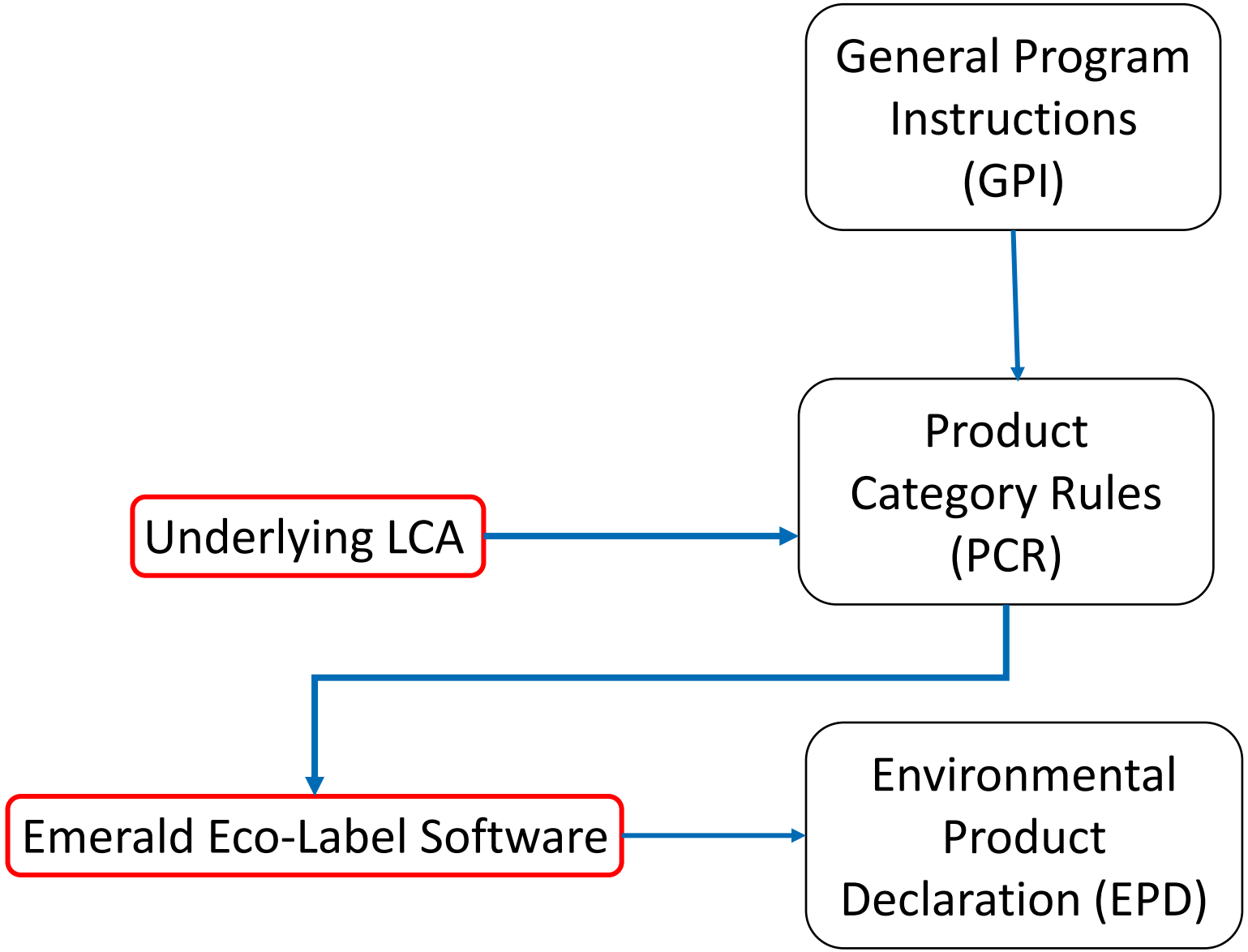
International Standards

ISO 14020/14025 – Environmental labels and declarations – Type III environmental declarations – General principles / Principles and procedures

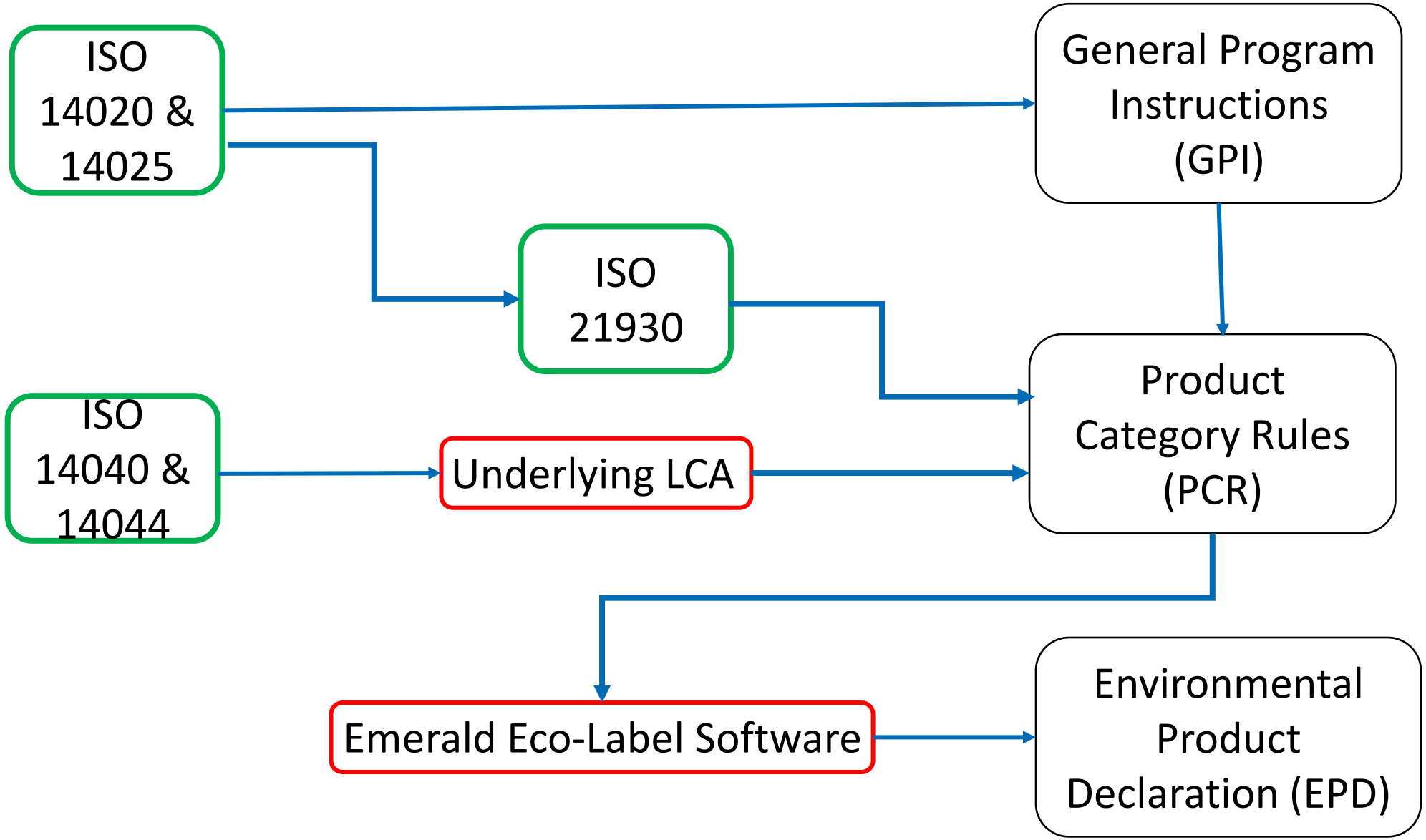
ISO 21930 – Sustainability in buildings and civil engineering works – Core rules for EPDs of construction products and services **(“Core PCR”)**

ISO 14040/14044 – Environmental management – Life cycle assessment – Principles and framework / Requirements and guidelines

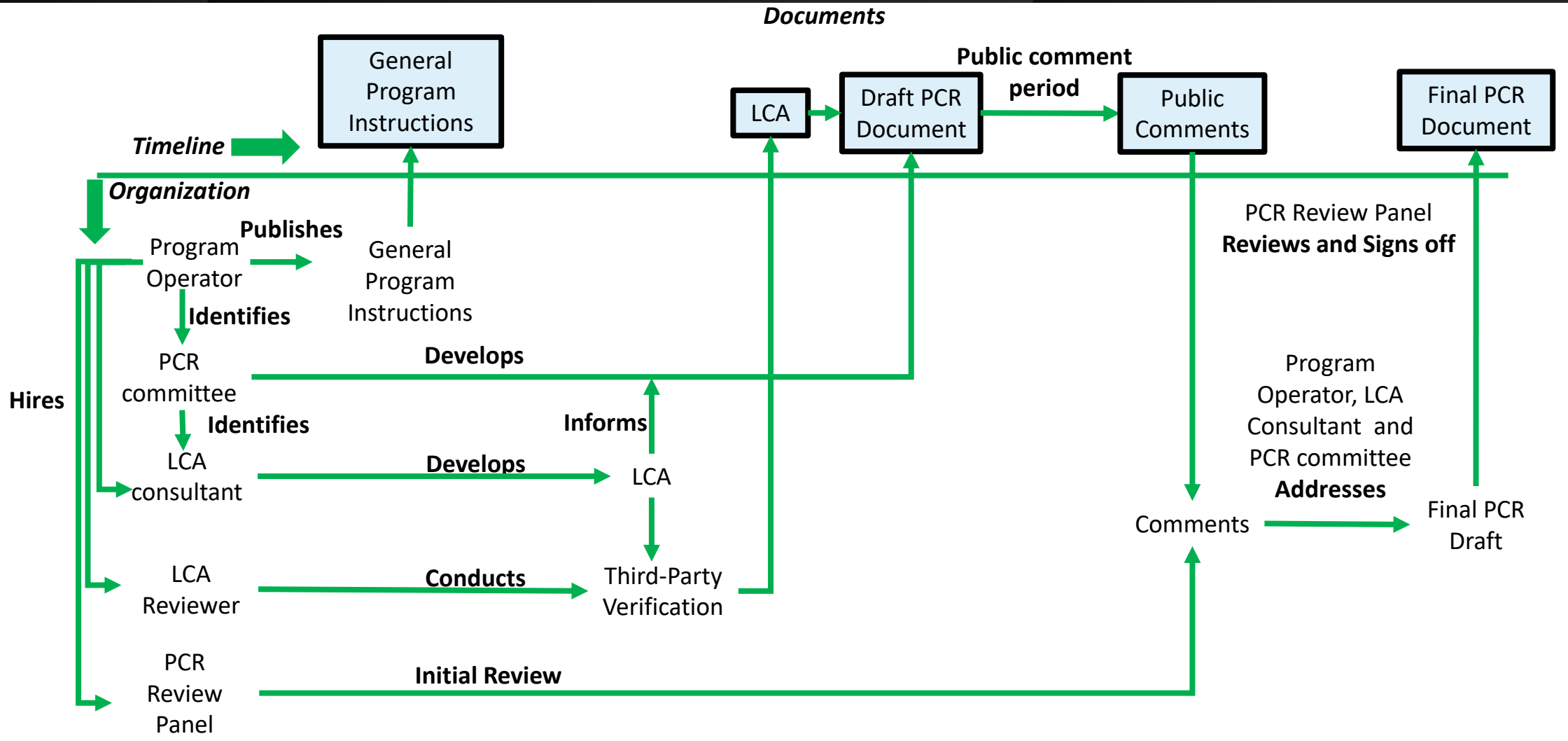
EPD Program – Key Elements



EPD Program: International Standards



PCR Development Process



Source: FHWA

Key Components of NAPA's EPD Program

Life Cycle Assessment (LCA)

- Representative survey of 50 plants
  - Conducted by Dr. Amlan Mukherjee (Michigan Tech)
- Complies with **ISO 14040/14044**
- **Underlying LCA** for the PCR for Asphalt Mixtures
- Also serves as the **LCA model** for NAPA's **Emerald Eco-Label EPD software tool**
- **Revised LCA** has been published for the new PCR

Update to the Life Cycle Assessment for Asphalt Mixtures in Support of the Emerald Eco Label Environmental Product Declaration Program

June 2021

Amlan Mukherjee, PhD, PE
Professor
Department of Civil, Environmental & Geospatial Engineering
Michigan Technological University
Houghton, MI 49931

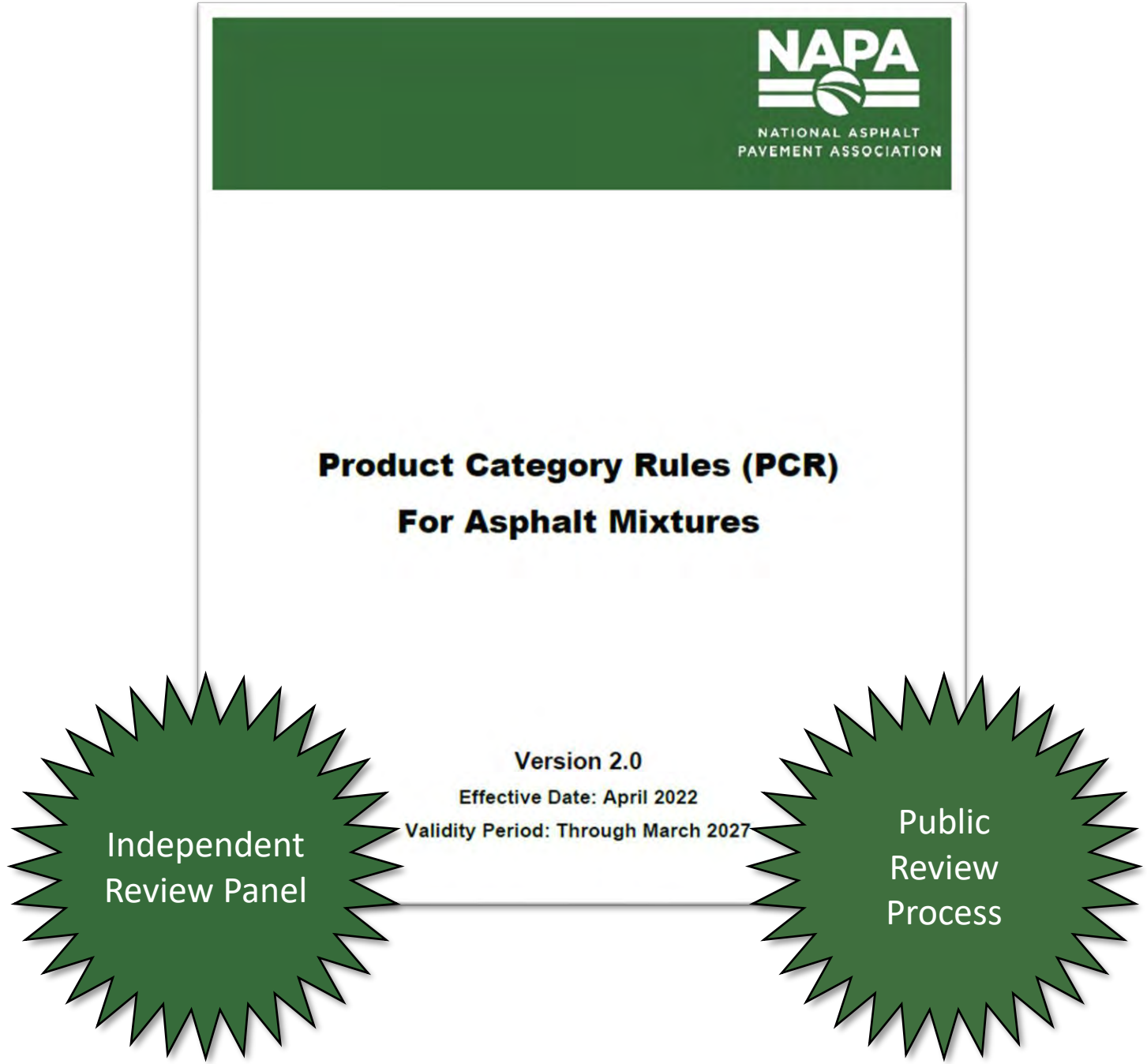
Michigan Tech

For:
National Asphalt Pavement Association
6406 Ivy Lane, Suite 350
Greenbelt, MD 20770-1441

3rd Party Critical Review

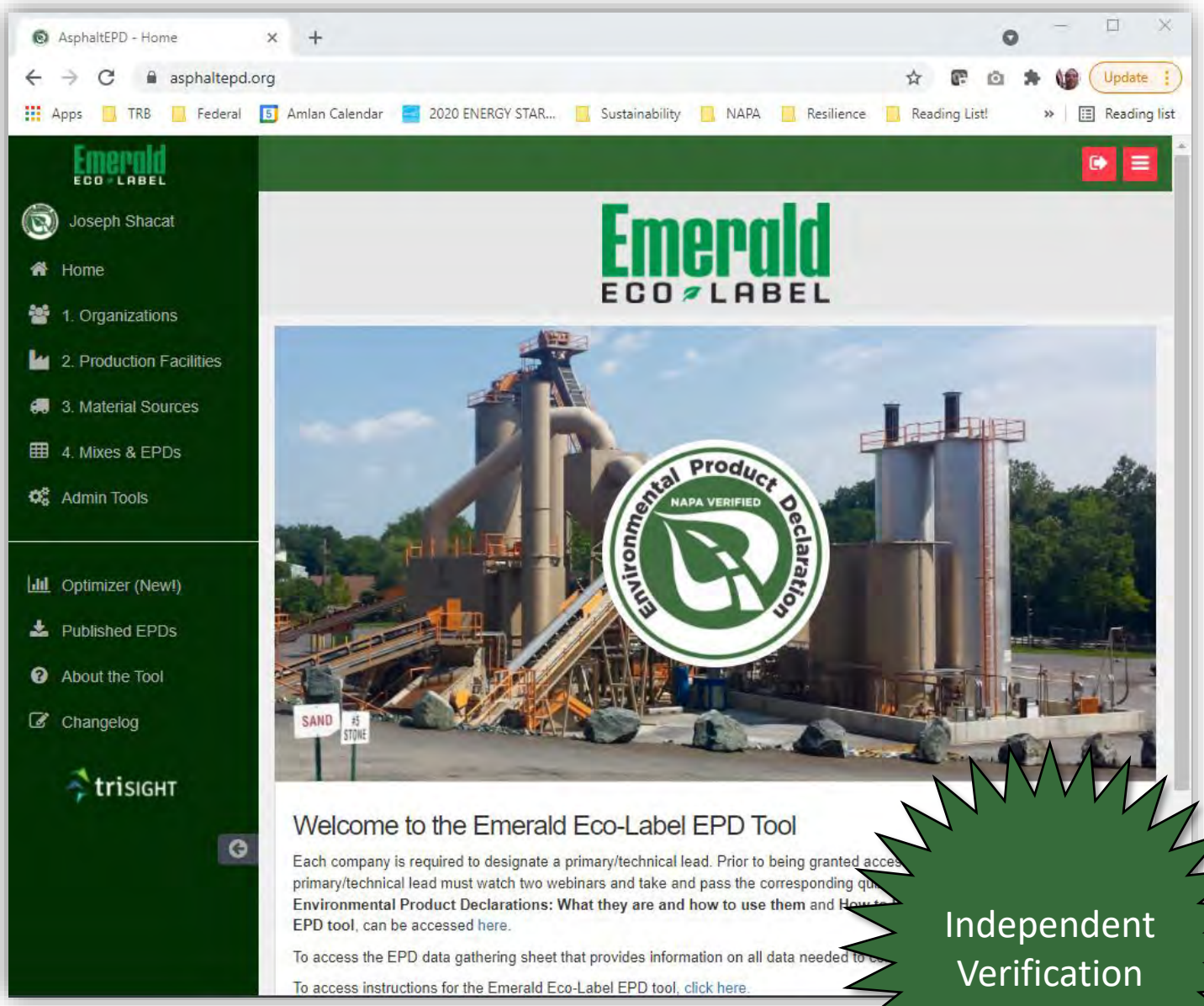
PCR for Asphalt Mixtures, v2

- Subcategory PCR under **ISO 21930**
- Complies with **ISO 14025** and **ISO 21930** standards
- **EPDs can be comparable** if asphalt mixtures meet similar performance criteria
- **Declared unit is 1 metric tonne (1 short ton)** of asphalt mixture
- Takes effect April 1, 2022
- More info at https://asphaltpavement.org/epd



Emerald Eco-Label Software

- NAPA's web-based **software tool**
- Asphalt mix producers use it to develop **verified EPDs**
- EPDs are **plant-specific** & **mix-specific**
- Can be used for **asphalt plants** located in the U.S.
- **Simplified process** that saves mix producers time and money

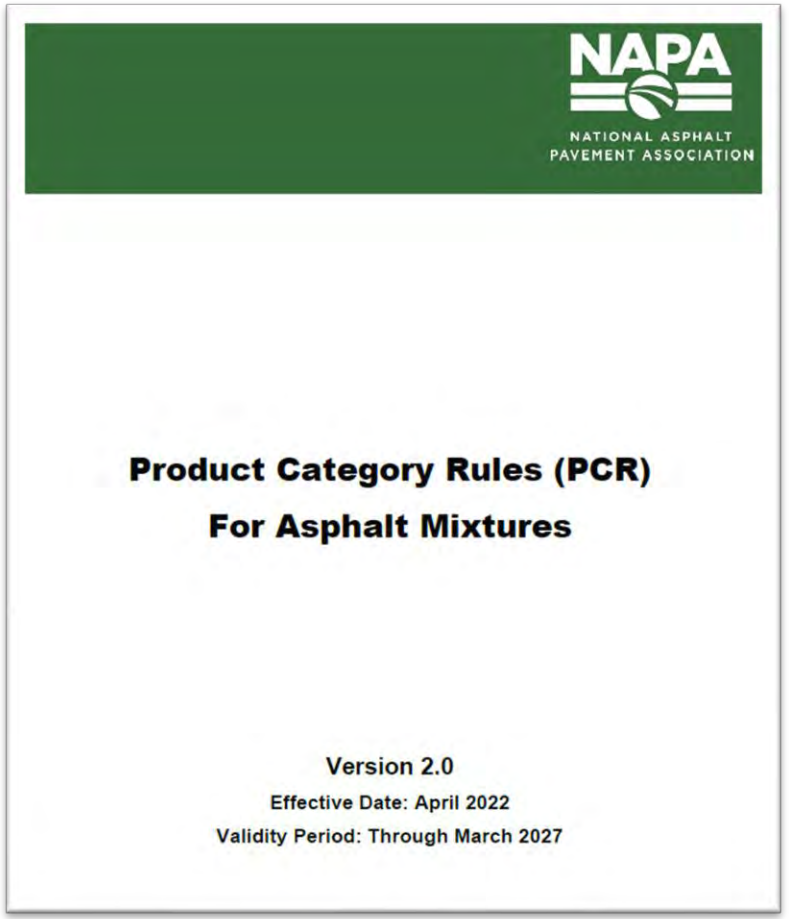


Independent Verification

PCR for Asphalt Mixtures
Scope and System Boundaries

Scope of the PCR

- **Technology** – plant-produced asphalt mixtures
  - Hot-mix, warm-mix, and cold central plant
  - Stationary and portable plants
- **Geography** – United States and Canada
- **Types of EPDs allowed**
  - Plant-specific mix-specific
  - Industry average



System Boundaries As Defined in ISO 21930

Construction Works Assessment Information														
Construction Works Life Cycle Information Within the System Boundary														Optional supplementary information beyond the system boundary
A1-A3			A4-A5		B1-B7					C1-C4				D
Production Stage (Cradle-to-Gate)			Construction Stage		Use Stage					End-Of-Life Stage				
A1	A2	A3	A4	A5	B1	B2	B3	B4[a]	B5	C1	C2	C3	C4	
Extractional upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance (incl. production, transport, and disposal of necessary materials)	Repair (incl. production, transport, and disposal of necessary materials)	Replacement (incl. Production, transport, and disposal of necessary materials)	Refurbishment (incl. Production, transport, and disposal of necessary materials)	Deconstruction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Potential net benefits from reuse, recycling, and/or energy recovery beyond the system boundary
					B6 Operational Energy Use *Scenario*									
					B7 Operational Water Use *Scenario*									

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

System Boundaries
As Defined in PCR for Asphalt Mixtures

Construction Works Assessment Information														
Construction Works Life Cycle Information Within the System Boundary														Optional supplementary information beyond the system boundary
A1-A3			A4-A5		B1-B7					C1-C4				D
Production Stage (Cradle-to-Gate)			Construction Stage		Use Stage					End-Of-Life Stage				
A1	A2	A3	A4	A5	B1	B2	B3	B4[a]	B5	C1	C2	C3	C4	
Extractional upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance (incl. production, transport, and disposal of necessary materials)	Repair (incl. production, transport, and disposal of necessary materials)	Replacement (incl. Production, transport, and disposal of necessary materials)	Refurbishment (incl. Production, transport, and disposal of necessary materials)	Deconstruction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Potential net benefits from reuse, recycling, and/or energy recovery beyond the system boundary
					B6 Operational Energy Use *Scenario*									
					B7 Operational Water Use *Scenario*									

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

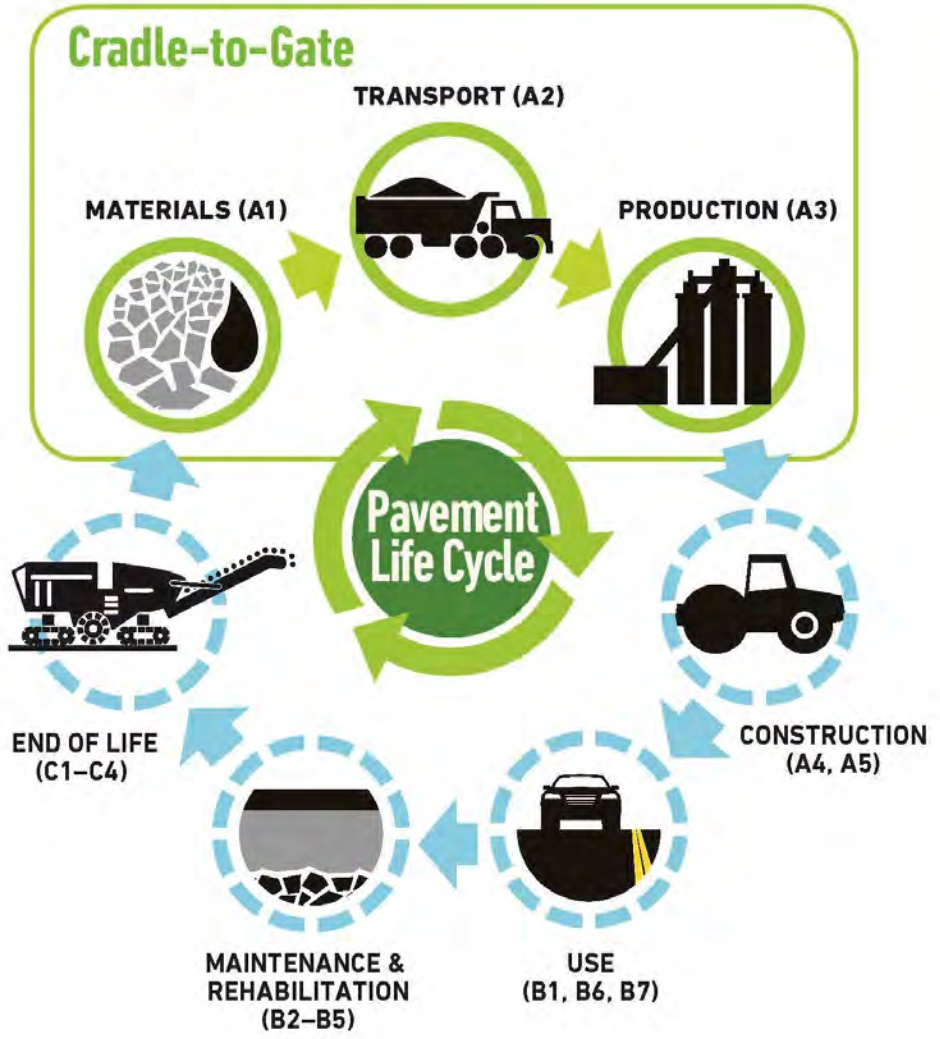
Recycled Materials and the Cut-Off Rule

- Secondary (recycled) materials enter the system burden free
- System boundary begins at the initial storage or processing location

Photo Credit: Asphalt Contractor

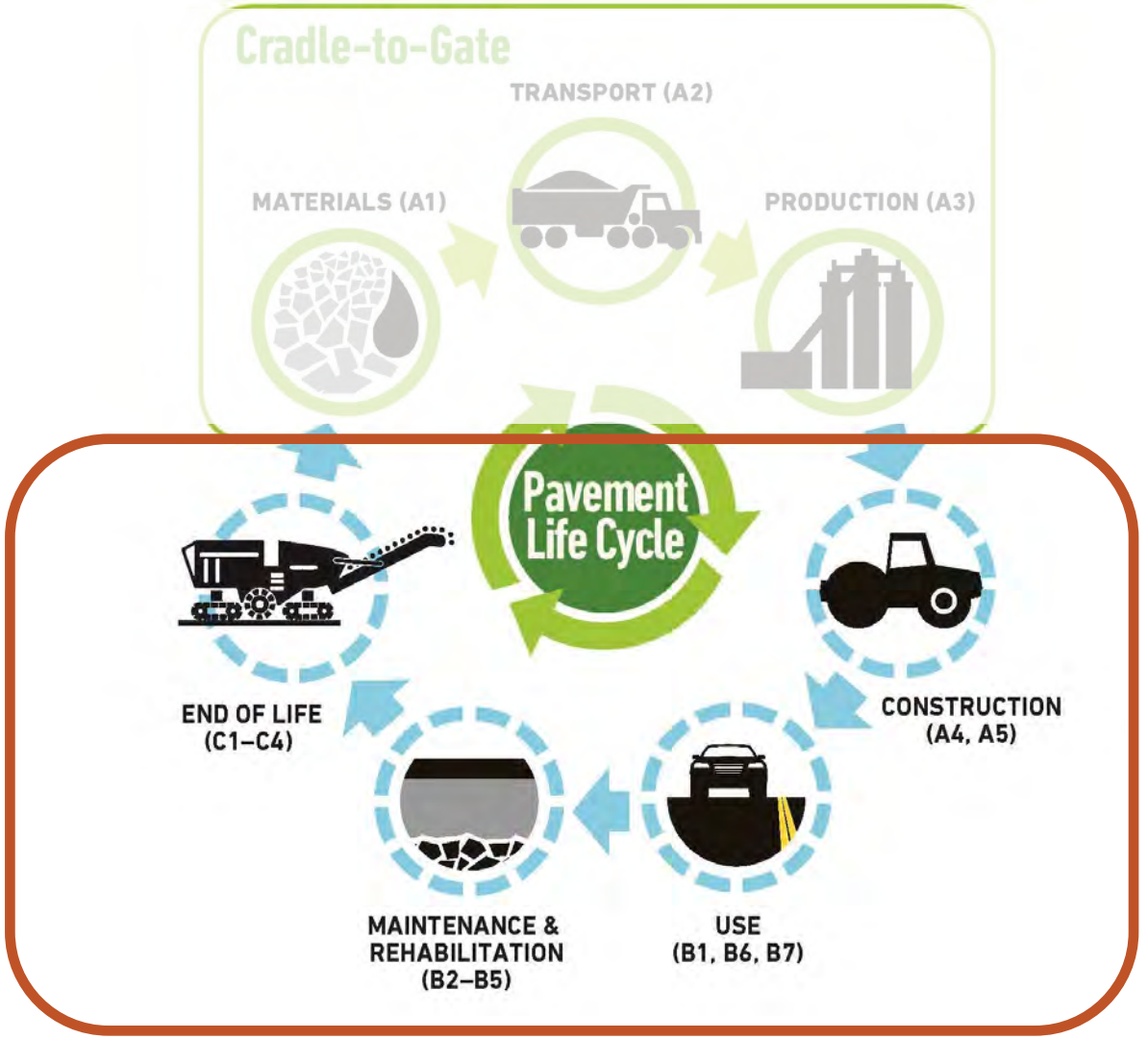
EPDs for asphalt mixtures have a Cradle-to-Gate scope

- **Included:**
  - Materials
  - Transport
  - Production
- **Other life cycle stages are not included**
  - Mix producers have little control over them



What about the other life cycle stages?

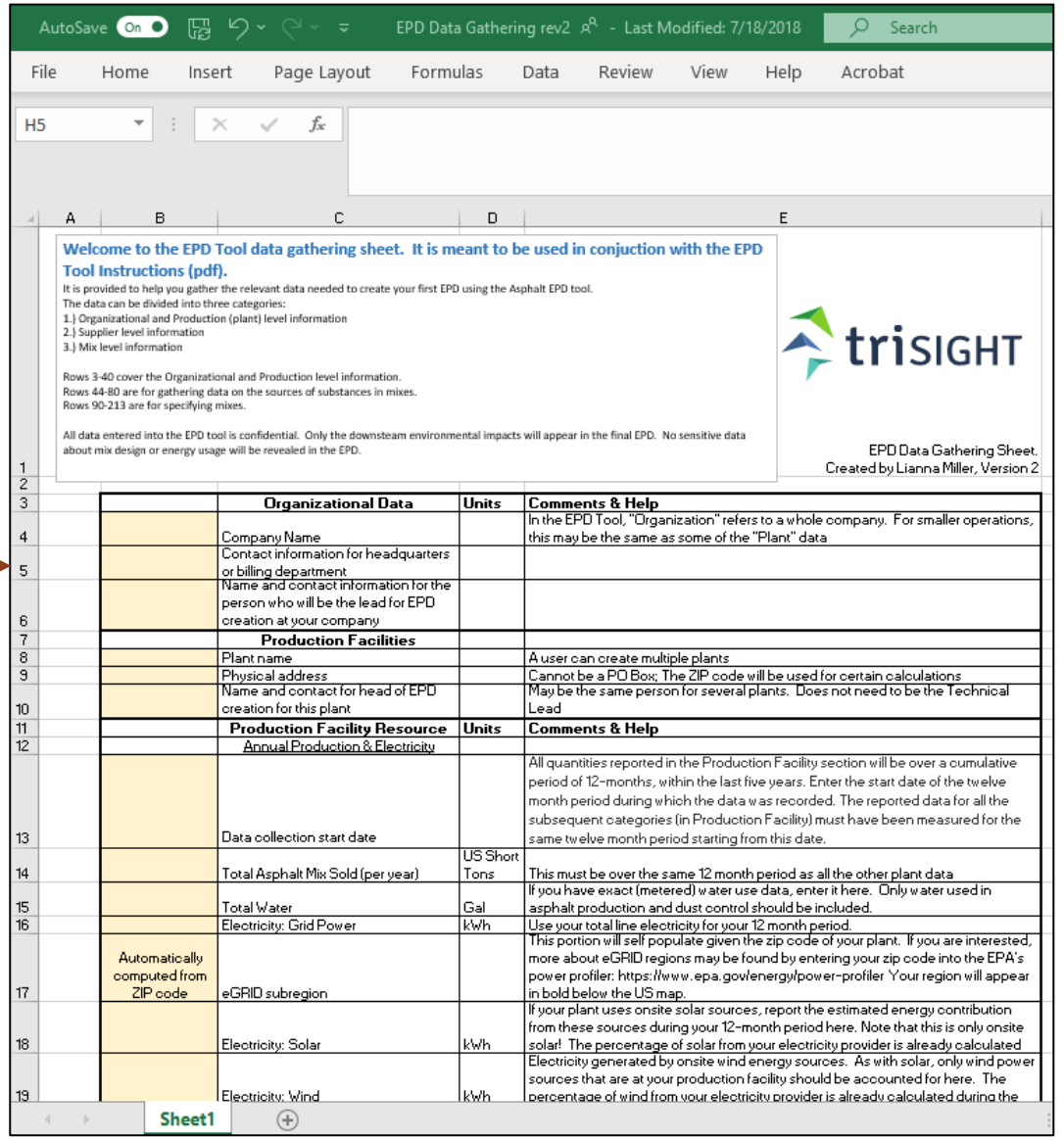
- **Outside the scope of the Asphalt EPD**
  - As defined in the Product Category Rules (PCR)
- **Mix producers have little control beyond the gate of the plant**
  - Construction quality
  - Pavement design
  - Traffic loading
  - Maintenance & rehabilitation treatments
  - End-of-life considerations
- **Owners can evaluate these stages through their own Life Cycle Assessment (LCA)**



Overview of Using Emerald Eco-Label to Develop an EPD for Asphalt Mixtures

How to use Emerald Eco-Label

- **Register** at https://asphaltepd.org/
- **Watch two webinars** and pass the quizzes
- **Compile data** for plant and mixes
  - Use EPD Data Gathering spreadsheet
- **Purchase access** for your plant(s)
- **Enter data** for plant and mixes to produce EPDs
- **Upload supporting documentation**



AutoSave On | EPD Data Gathering rev2 - Last Modified: 7/18/2018 | Search

File Home Insert Page Layout Formulas Data Review View Help Acrobat

H5

Welcome to the EPD Tool data gathering sheet. It is meant to be used in conjuction with the EPD Tool Instructions (pdf).

It is provided to help you gather the relevant data needed to create your first EPD using the Asphalt EPD tool.
The data can be divided into three categories:
1.) Organizational and Production (plant) level information
2.) Supplier level information
3.) Mix level information

Rows 3-40 cover the Organizational and Production level information.
Rows 44-80 are for gathering data on the sources of substances in mixes.
Rows 90-213 are for specifying mixes.

All data entered into the EPD tool is confidential. Only the downsteam environmental impacts will appear in the final EPD. No sensitive data about mix design or energy usage will be revealed in the EPD.

trisIGHT

EPD Data Gathering Sheet.
Created by Lianna Miller, Version 2

	Organizational Data	Units	Comments & Help
	Company Name		In the EPD Tool, "Organization" refers to a whole company. For smaller operations, this may be the same as some of the "Plant" data
	Contact information for headquarters or billing department		
	Name and contact information for the person who will be the lead for EPD creation at your company		
	Production Facilities		
	Plant name		A user can create multiple plants
	Physical address		Cannot be a PO Box; The ZIP code will be used for certain calculations
	Name and contact for head of EPD creation for this plant		May be the same person for several plants. Does not need to be the Technical Lead
	Production Facility Resource	**Units**	**Comments & Help**
	Annual Production & Electricity		
	Data collection start date		All quantities reported in the Production Facility section will be over a cumulative period of 12-months, within the last five years. Enter the start date of the twelve month period during which the data was recorded. The reported data for all the subsequent categories (in Production Facility) must have been measured for the same twelve month period starting from this date.
	Total Asphalt Mix Sold (per year)	US Short Tons	This must be over the same 12 month period as all the other plant data
	Total Water	Gal	If you have exact (metered) water use data, enter it here. Only water used in asphalt production and dust control should be included.
	Electricity: Grid Power	kWh	Use your total line electricity for your 12 month period.
Automatically computed from ZIP code	eGRID subregion		This portion will self populate given the zip code of your plant. If you are interested, more about eGRID regions may be found by entering your zip code into the EPA's power profiler: https://www.epa.gov/energy/power-profiler Your region will appear in bold below the US map.
	Electricity: Solar	kWh	If your plant uses onsite solar sources, report the estimated energy contribution from these sources during your 12-month period here. Note that this is only onsite solar! The percentage of solar from your electricity provider is already calculated
	Electricity: Wind	kWh	Electricity generated by onsite wind energy sources. As with solar, only wind power sources that are at your production facility should be accounted for here. The percentage of wind from your electricity provider is already calculated during the

Sheet1

Data requirements for the plant

- **12 consecutive months of data**
  - Within the past five years
- **Fuel consumption**
  - Burner
  - Hot oil heater
  - Generator
  - Equipment
- **Electricity consumption**
- **Water consumption**
- **Total mix sold (tons)**

Your data is confidential!

Photo courtesy of Duval Asphalt

Data requirements for the plant (new requirements for the new PCR)

- **Waste material tonnage (12-month total)**
  - Baghouse fines, off-spec mix, start-up/shut-down waste, etc.
  - Disposition (landfill vs. recycling/reuse)
  - Distance to landfill/next use
- **RAP/RAS transport distance**
  - From initial stockpile/processing location to asphalt plant
- **Procurement of clean energy***
  - Emission benefits from RECs, PPAs, etc.
- **Portable plants***
  - Distance of last transport

* Not initially supported with Emerald Eco-Label software

Photo courtesy of Duval Asphalt

Data requirements for mix designs

- **Material content (by weight of total mix)**
  - Aggregates
  - Asphalt binder
  - RAP and RAS
  - Additives
- **Transportation mode and distance**
  - Truck, rail, or barge
- **Mix production temperature**

Your data is confidential!

Photo courtesy of Rock Road Companies, Inc.

Data requirements for mix designs (new requirements for the new PCR)

- **Safety Data Sheet (SDS) info**
  - List of "hazardous substances" in the SDS
  - Link to access the SDS
- **Mix Properties** (optional)
  - Gradation, nominal maximum aggregate size, PG grade of binder, etc.
- **Portable plants***
  - Revise mix design and material transport distance for each new location

* Not initially supported with Emerald Eco-Label software

Photo courtesy of Rock Road Companies, Inc.

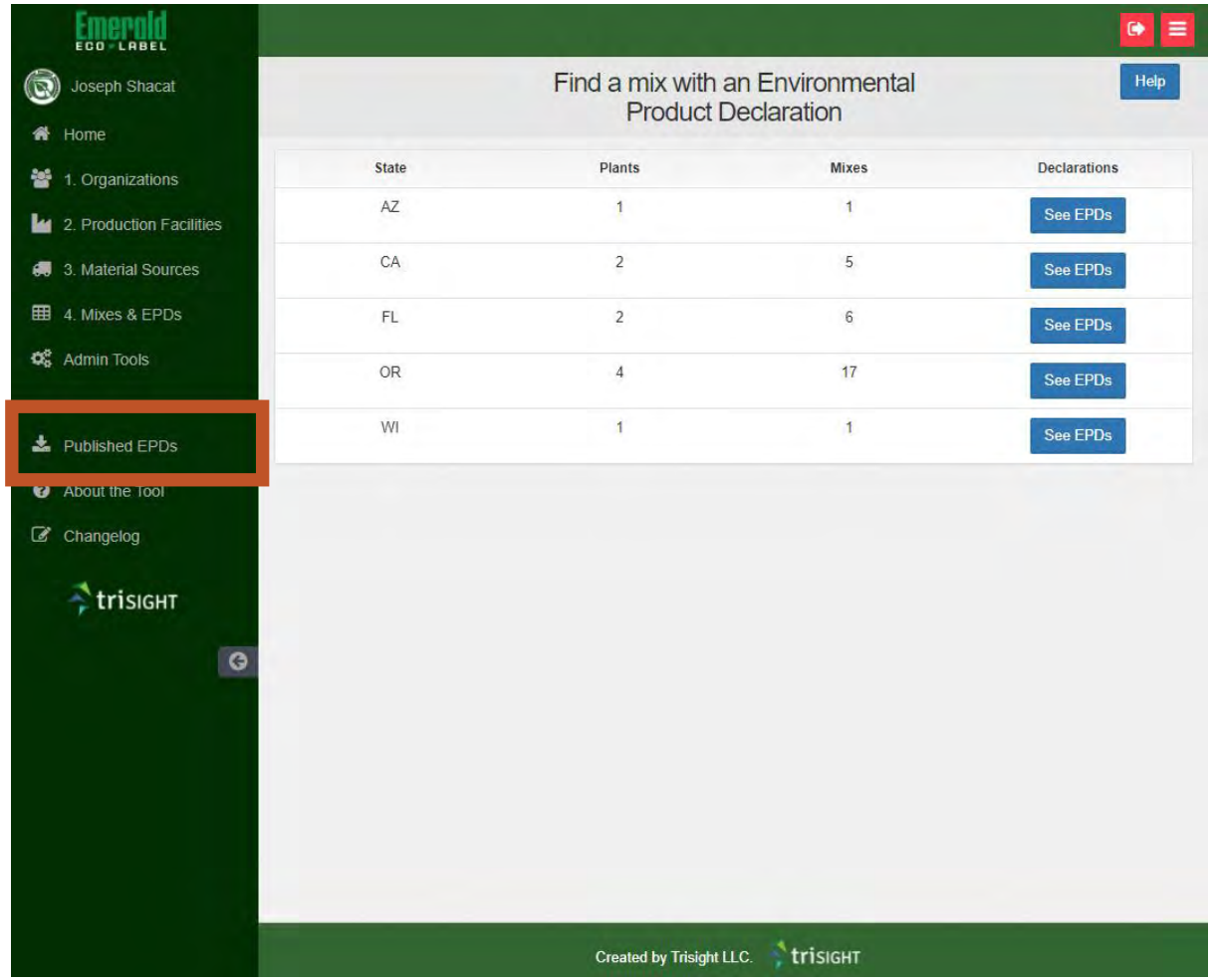
Upstream datasets

- **The PCR requires the use of public datasets for upstream energy and materials**
  - Fuels and electricity
  - Aggregates
  - Asphalt binder
- **Data gaps are noted in the EPD**
  - Binder additives (polymers, ground tire rubber, etc.)
  - Mix additives (WMA, rejuvenators, fibers, etc.)
- **Cannot develop EPD if data gap >1% (individual material) or 5% (total) of mix by weight**

FEDERAL LCA COMMONS

Publishing an EPD

- **Publish completed EPDs with a single click!**
- **EPDs are published at https://asphaltepd.org/published/**
- **Other websites collect and post published EPDs**

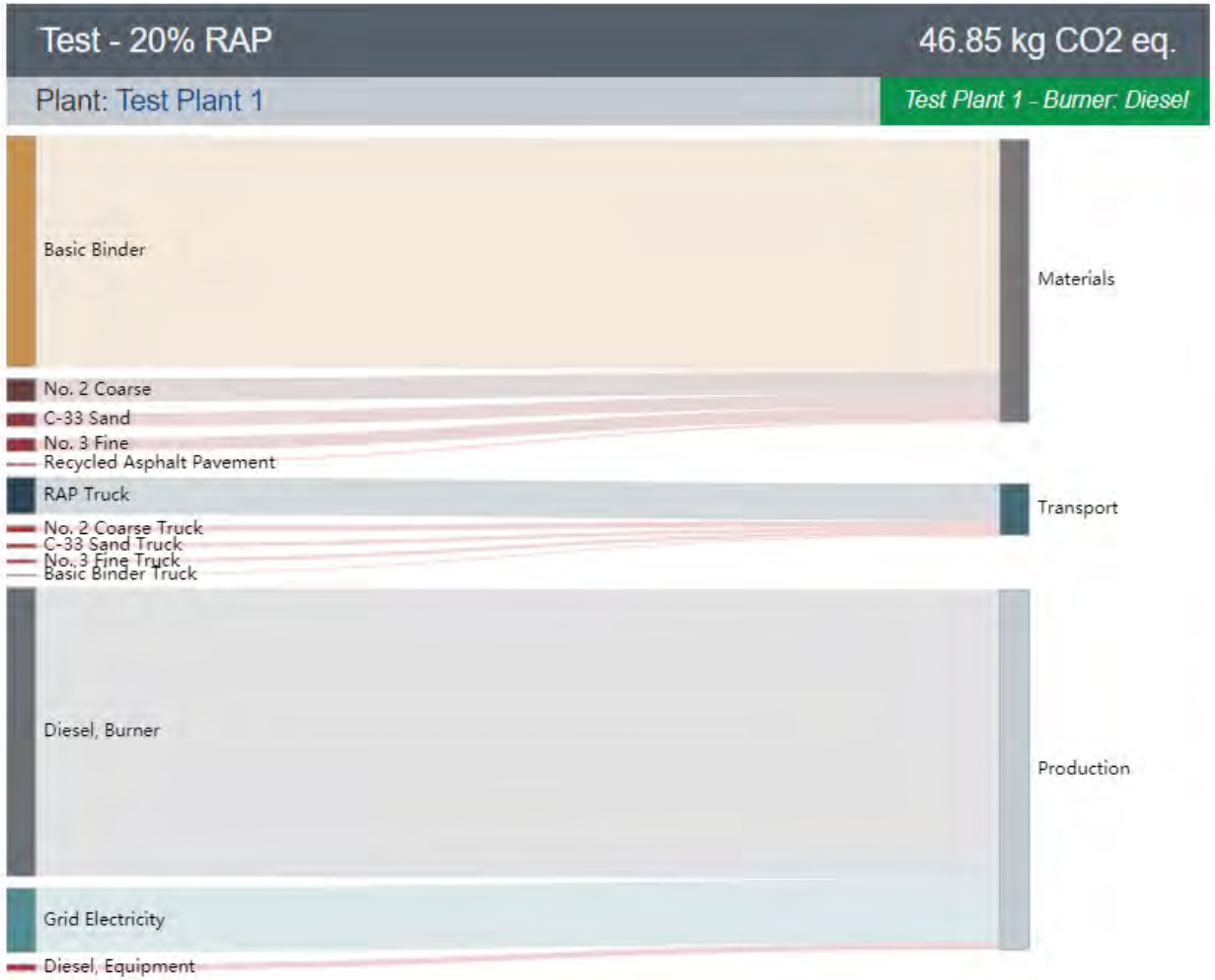


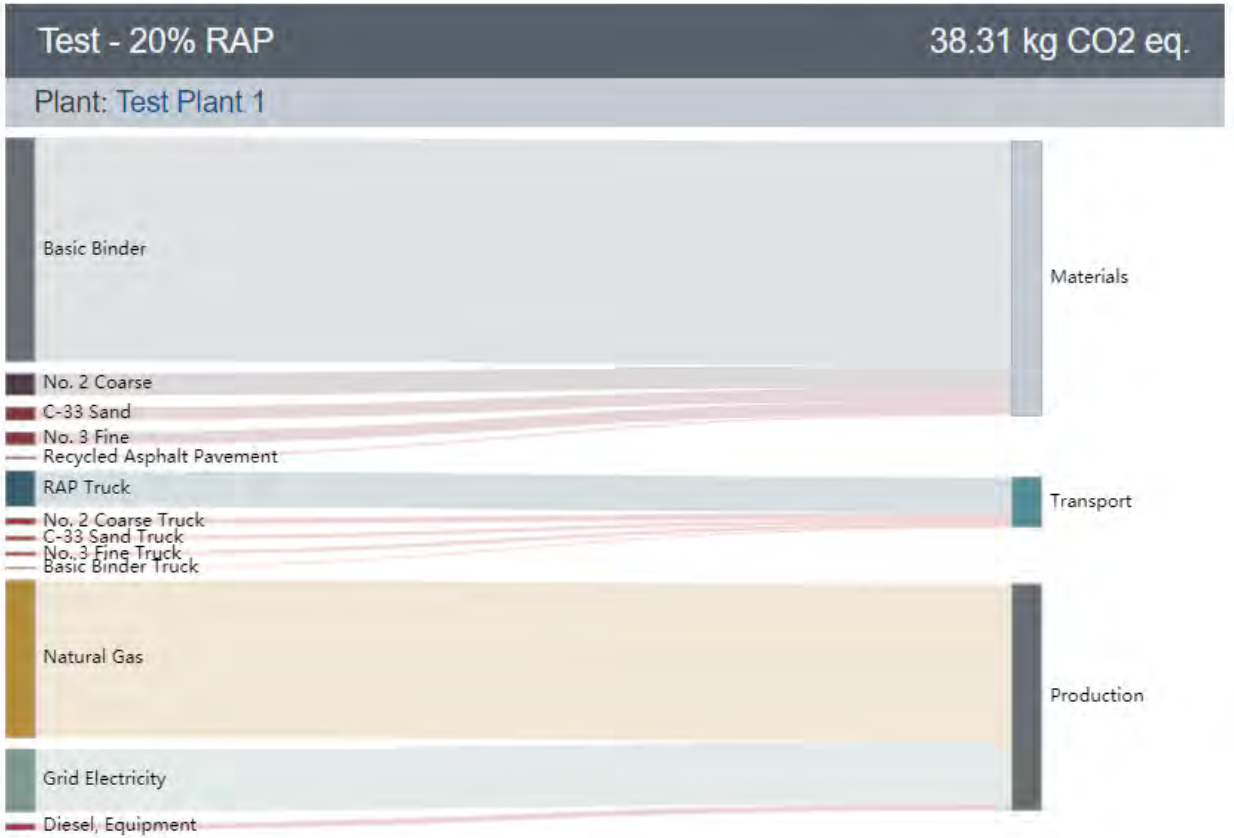
EPD Optimizer Tool

- Easily **compare** two of your own mixes to each other
- More **granular analysis** of data
- Create **plant variants** to see how changes to plant operations affect EPDs
- Evaluate **economic** and **environmental** impacts of certain changes
  - Switching fuel types
  - Aggregate moisture reduction

Emerald ECO LABEL OPTIMIZER BETA

Comparing Burner Fuels with the Optimizer





Software Limitations – Features Not Currently Supported

- **Portable asphalt plants**
- **CCPR**
  - Plants that produce both HMA/WMA and CCPR
  - CCPR when emulsified asphalt is the binder (data gap)
- **Emission reductions from purchase of renewable energy**
- **Plants located in Canada**
- **Mixes that use slag aggregates** (data gap)
- **Additional environmental information**
  - ENERGY STAR, NAPA Awards and Commendations, Environmental Management System
- **Optimizer**

Check NAPA website for Statement of Limitations

How to Read an EPD for Asphalt Mixture

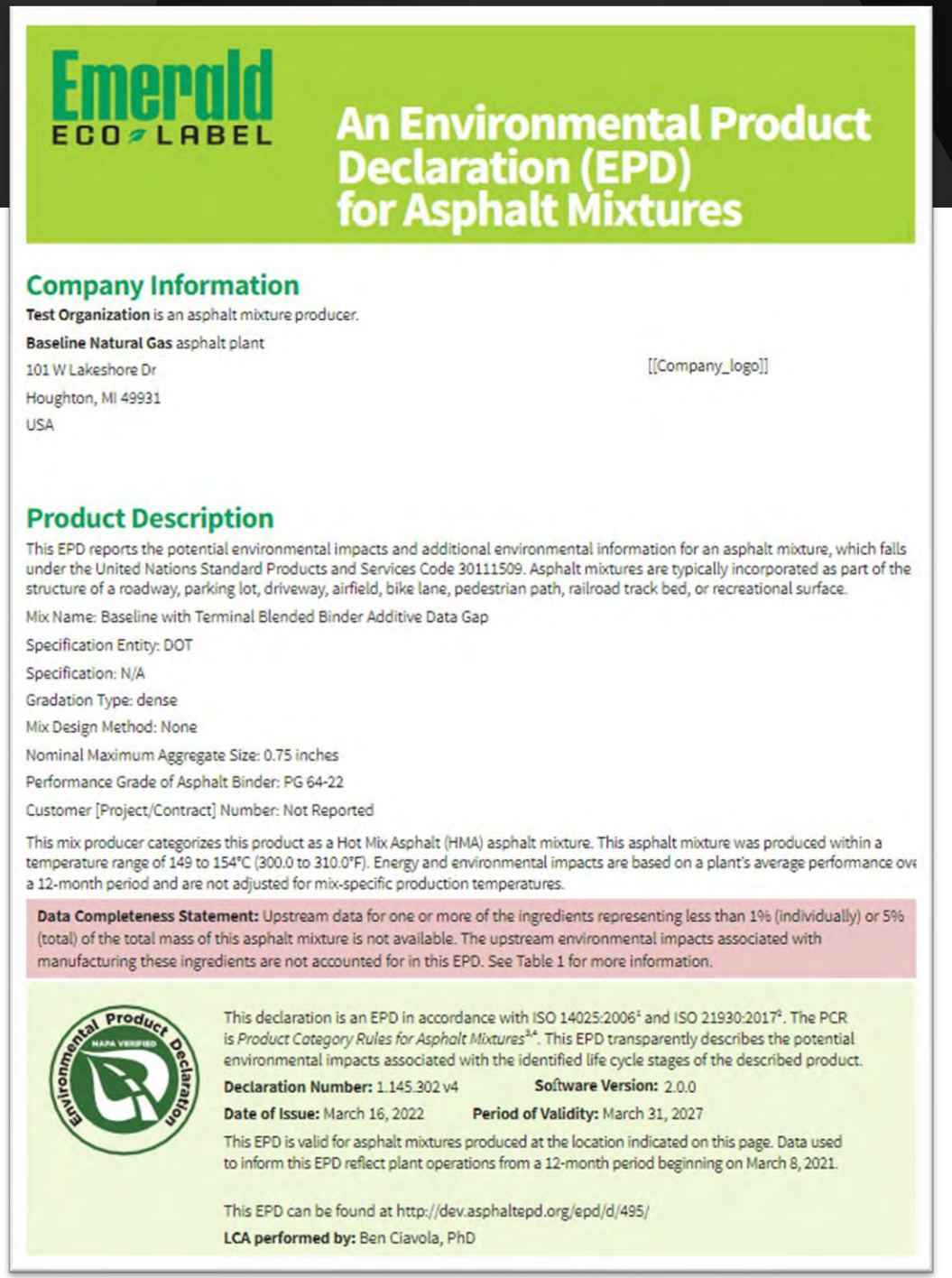
Cover Page

Company and Plant Information →

Product Description →

Red box indicates a data gap →

Green box has info about the EPD →



Emerald ECO LABEL

An Environmental Product Declaration (EPD) for Asphalt Mixtures

Company Information

Test Organization is an asphalt mixture producer.

Baseline Natural Gas asphalt plant

101 W Lakeshore Dr

Houghton, MI 49931

USA

[[Company_logo]]

Product Description

This EPD reports the potential environmental impacts and additional environmental information for an asphalt mixture, which falls under the United Nations Standard Products and Services Code 30111509. Asphalt mixtures are typically incorporated as part of the structure of a roadway, parking lot, driveway, airfield, bike lane, pedestrian path, railroad track bed, or recreational surface.

Mix Name: Baseline with Terminal Blended Binder Additive Data Gap

Specification Entity: DOT

Specification: N/A

Gradation Type: dense

Mix Design Method: None

Nominal Maximum Aggregate Size: 0.75 inches

Performance Grade of Asphalt Binder: PG 64-22

Customer [Project/Contract] Number: Not Reported

This mix producer categorizes this product as a Hot Mix Asphalt (HMA) asphalt mixture. This asphalt mixture was produced within a temperature range of 149 to 154°C (300.0 to 310.0°F). Energy and environmental impacts are based on a plant's average performance ove a 12-month period and are not adjusted for mix-specific production temperatures.

Data Completeness Statement: Upstream data for one or more of the ingredients representing less than 1% (individually) or 5% (total) of the total mass of this asphalt mixture is not available. The upstream environmental impacts associated with manufacturing these ingredients are not accounted for in this EPD. See Table 1 for more information.

Environmental Product Declaration — NAPA VERIFIED

This declaration is an EPD in accordance with ISO 14025:2006[1] and ISO 21930:2017[2]. The PCR is *Product Category Rules for Asphalt Mixtures*[3,4]. This EPD transparently describes the potential environmental impacts associated with the identified life cycle stages of the described product.

Declaration Number: 1.145.302 v4 **Software Version:** 2.0.0

Date of Issue: March 16, 2022 **Period of Validity:** March 31, 2027

This EPD is valid for asphalt mixtures produced at the location indicated on this page. Data used to inform this EPD reflect plant operations from a 12-month period beginning on March 8, 2021.

This EPD can be found at http://dev.asphaltepd.org/epd/d/495/

LCA performed by: Ben Ciavola, PhD

Environmental Impact Indicators

TABLE 4. LIFE CYCLE IMPACT INDICATORS

ACRONYM	INDICATOR	UNIT	QUANTITY PER METRIC TONNE ASPHALT MIXTURE (PER SHORT TON ASPHALT MIXTURE)			
			MATERIALS (A1)	TRANSPORT (A2)	PRODUCTION (A3)	TOTAL (A1-A3)
GWP-100	*Global warming potential, incl. biogenic CO2*	*kg CO2 Equiv.*	*33.77 (30.63)*	*4.22 (3.82)*	*23.32 (21.15)*	*61.30 (55.61)*
ODP	*Ozone depletion potential*	*kg CFC-11 Equiv.*	*1.79e-08 (1.63e-08)*	*2.55e-08 (2.31e-08)*	*6.24e-08 (5.66e-08)*	*1.06e-07 (9.60e-08)*
EP	*Eutrophication potential*	*kg N Equiv.*	*8.95e-03 (8.12e-03)*	*1.26e-03 (1.14e-03)*	*2.38e-03 (2.16e-03)*	*1.26e-02 (1.14e-02)*
AP	*Acidification potential*	*kg SO2 Equiv.*	*9.62e-02 (8.73e-02)*	*2.15e-02 (1.95e-02)*	*4.23e-02 (3.84e-02)*	*1.60e-01 (1.45e-01)*
POCP	*Photochemical ozone creation potential*	*kg O3 Equiv.*	*1.98 (1.79)*	*0.69 (0.63)*	*1.25 (1.14)*	*3.92 (3.56)*

Environmental Impact Indicators

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Environmental Impact Indicators

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GWP-100	*Global warming potential, incl. biogenic CO2*	*kg CO2 Equiv.*	*33.77 (30.63)*	*4.22 (3.82)*	*23.32 (21.15)*	*61.30 (55.61)*

GWP
61.30 kg CO_2e per metric tonne
55.61 kg CO_2e per short ton

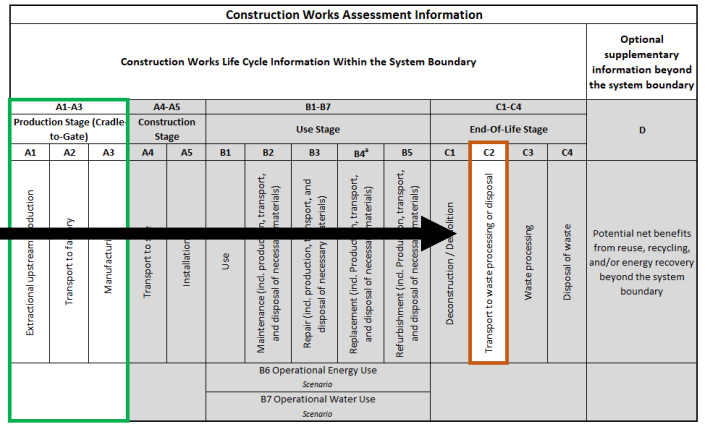
End-of-Life Transport

An Environmental Product Declaration for Asphalt Mixtures

END-OF-LIFE CONSIDERATIONS FOR PAVEMENT LCA STUDIES

This is a cradle to gate EPD and does not include life cycle stages beyond the gate of the plant. According to the cut-off rules, transportation of RAP from the pavement rehabilitation jobsite to the initial storage or processing location (module C2) is not included. When this EPD is used as a data input for an LCA study that includes the end-of-life stage, the recommended default value for transportation of RAP from the pavement rehabilitation site to the initial storage or processing location is 53km (33 miles).

Additional information regarding C2 (end-of-life transport)



Construction Works Assessment Information														
Construction Works Life Cycle Information Within the System Boundary														Optional supplementary information beyond the system boundary
A1-A3 Production Stage (Cradle-to-Gate)			A4-A5 Construction Stage		B1-B7 Use Stage					C1-C4 End-Of-Life Stage				D
A1	A2	A3	A4	A5	B1	B2	B3	B4[a]	B5	C1	C2	C3	C4	
Extractional upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance (incl. production, transport, and disposal of necessary materials)	Repair (incl. production, transport, and disposal of necessary materials)	Replacement (incl. Production, transport, and disposal of necessary materials)	Refurbishment (incl. Production, transport, and disposal of necessary materials)	Deconstruction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Potential net benefits from reuse, recycling, and/or energy recovery beyond the system boundary
					B6 Operational Energy Use Scenario									
					B7 Operational Water Use Scenario									

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

Common Questions About EPDs

What is the time and cost of developing EPDs?

Pricing Schedule as of Apr. 1, 2022

Year	Member Rate	Non-member Rate	Years of Tool Access
2022	$3,000 per plant	$6,000 per plant	5
2023	$3,000 per plant	$6,000 per plant	4
2024	$2,750 per plant	$5,500 per plant	3
2025	$2,500 per plant	$5,000 per plant	2
2026	$2,250 per plant	$4,500 per plant	1

- **Initial data collection and plant setup takes most companies a couple of weeks**
- **New mixes typically take 10-15 minutes**

Does the EPD give credit for Warm Mix?

https://www.fhwa.dot.gov/publications/focus/08apr/03.cfm

- **What are the biggest contributors to GHG emissions?**
  - **Burner fuel** consumption
  - **Asphalt binder** content
  - Sometimes, **aggregate hauling** exceeds everything else

Can EPDs for Asphalt Mixtures be Compared to Each Other?

EPDs for different asphalt mixtures are comparable if:

- They perform a similar function and have similar performance characteristics

Examples of mixes that should not be compared to each other:

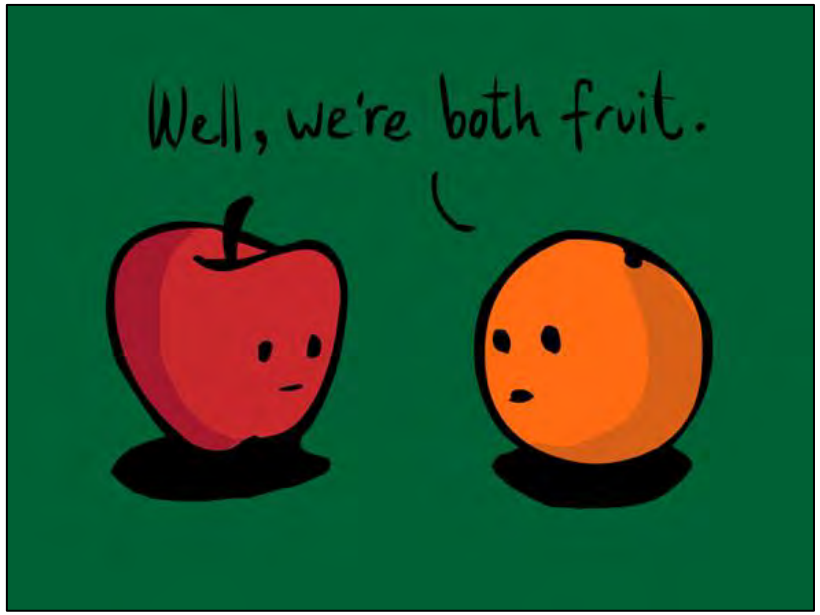
- Porous vs. dense-graded
- Base mix vs. surface mix

Beware of data gaps!

Can EPDs for Asphalt Mixtures be Compared to EPDs for Concrete?

- **Other pavement materials have different PCRs and should not be compared to each other:**
  - Ready-mix concrete
  - Precast concrete panels
  - Interlocking concrete pavers

- **Significant differences:**
  - **Declared units** (short ton vs. m^3)
  - **Upstream datasets** (fuels, electricity, materials, etc.)
  - **Allocation procedures** (co-products vs recycled materials)
  - **Design** considerations
  - **Maintenance** and **rehabilitation** strategies



But they may not have the same PCR!

Benefits for Mix Producers

- **Use EPDs for marketing**
  - Attract customers for LEED projects and other green rating systems
- **Use EPDs for advocacy**
  - e.g., demonstrate GHG emission reductions from using RAP
- **Improve your company's environmental performance**
  - Track changes to plant operations and mix designs over time
- **Integrate with corporate sustainability reporting**
- **Demonstrate commitment to sustainability**
  - Attract and retain workforce

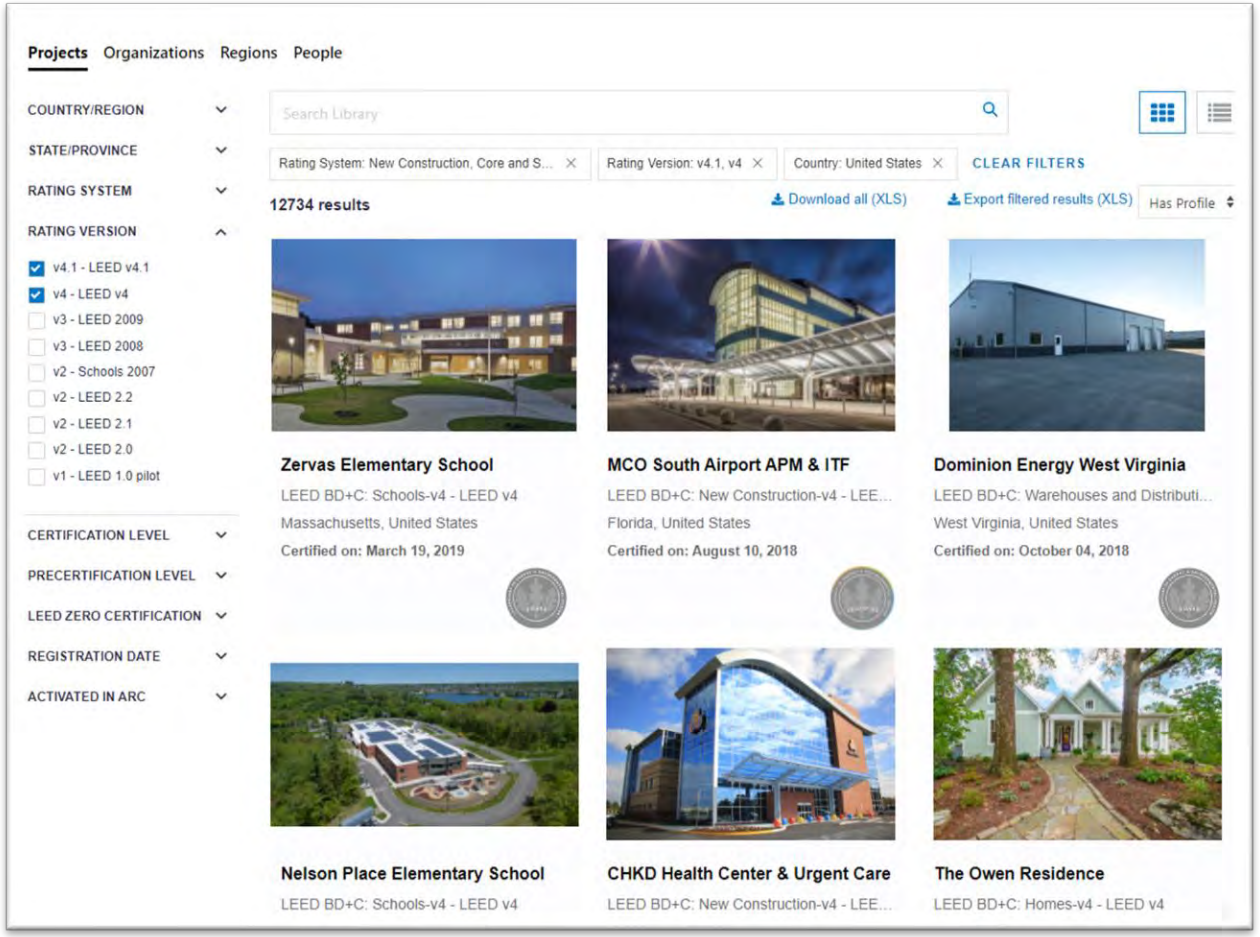
Photo courtesy of Lakeside Industries

Using EPDs as a Marketing Tool

Searchable database of LEED projects at https://www.usgbc.org/projects

- Filter for your state
- Select all LEED BD+C rating systems
- Select LEED v4 & v4.1 rating versions
- Set registration date to see recent projects
- Export filtered list of projects in your area (.xls file)

NAPA's LEED Guidance available at https://www.asphaltpavement.org/expertise/sustainability/sustainability-resources



Workforce Development

More than half of young people surveyed think 'humanity is doomed' due to climate change

Last Updated: Dec. 11, 2021 at 10:53 a.m. ET
First Published: Dec. 10, 2021 at 1:18 p.m. ET

By Rachel Koning Beals

23

Three-quarters of respondents under age 25 said they believe 'the future is frightening' in Lancet-published global survey

https://www.marketwatch.com/story/more-than-half-of-young-people-surveyed-think-humanity-is-doomed-due-to-climate-change-11639160312

CNBC MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV WATCHLIST CRAMER PRO

Gen Z grew up with climate change. Now it's starting to have an effect on their career choices

PUBLISHED THU, NOV 12 2020•10:00 AM EST | UPDATED THU, NOV 12 2020•3:51 PM EST

Amanda Mier

SHARE

https://www.cnbc.com/2020/11/12/gen-z-grew-up-with-climate-change-now-its-affecting-career-choices.html

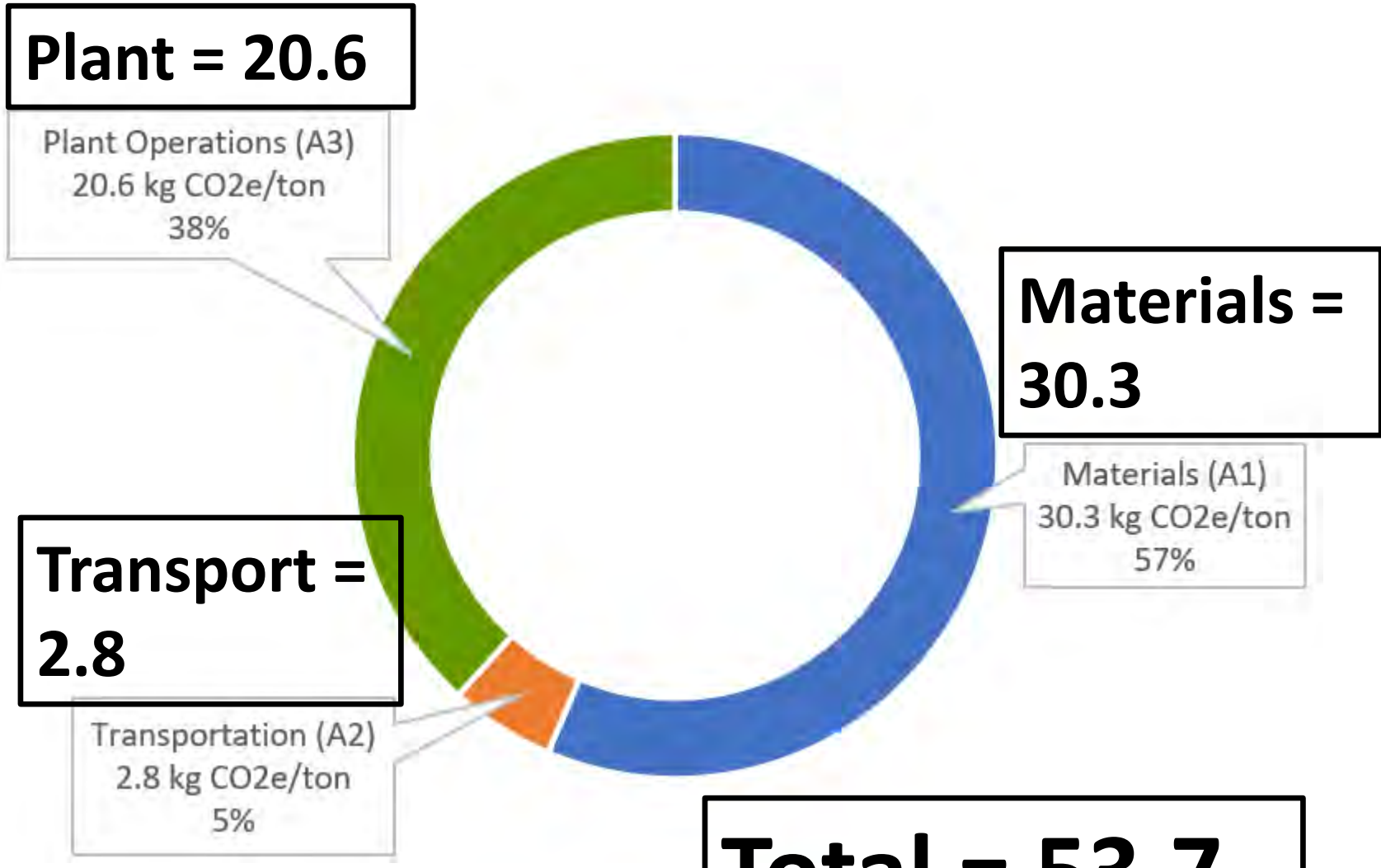
General Implementation Concerns

- **Education** – Need to get the word out!
- **How many** separate "products" need to be benchmarked?
  - Can/should certain specifications be grouped together?
  - **More data = better decisions.**
- **Regional** Differences
  - Which regions matter?
  - Need data (EPDs) to determine. **More data = better decisions.**
- Impacts of **data gaps** on benchmark development, decision making, etc.
- Be wary of the **ceiling** for GWP limits
  - How will this be affected by data gaps??

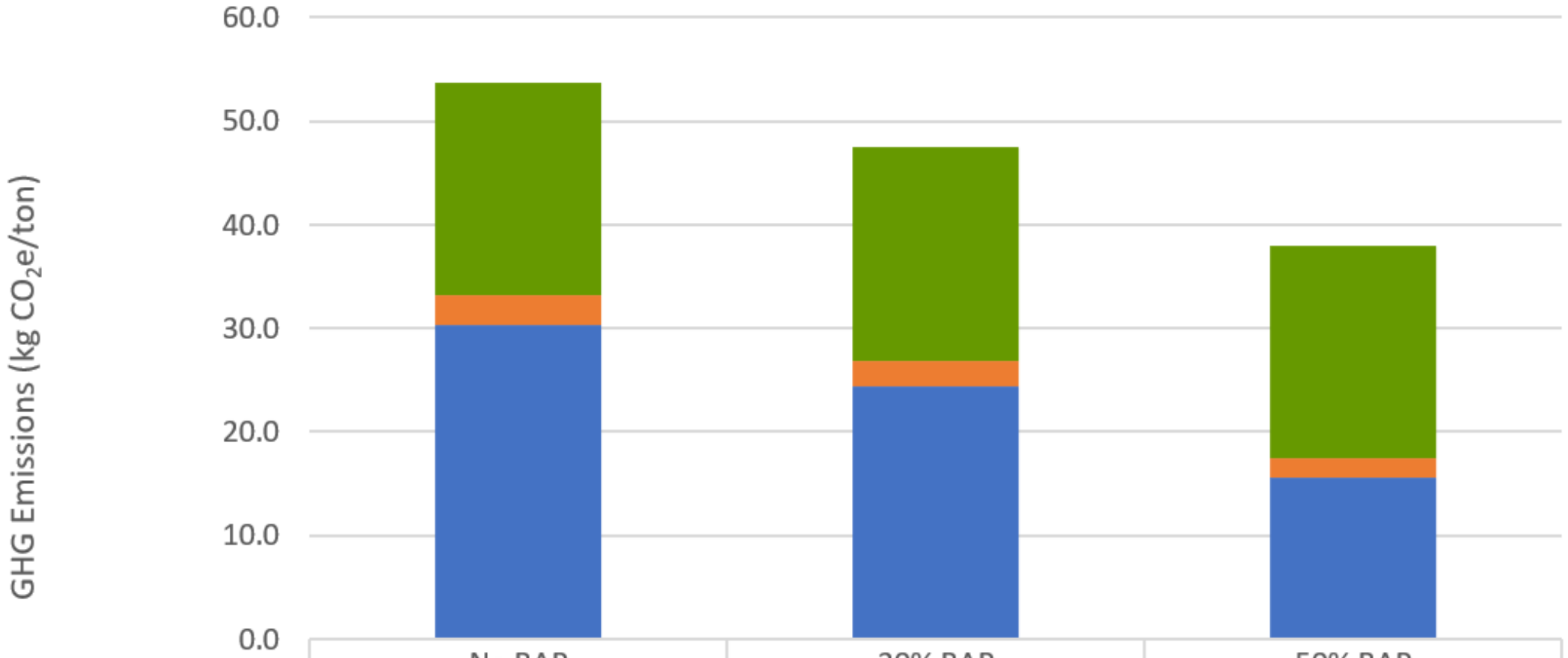
Scenarios

Baseline Reference Scenario

- Burner = Natural Gas
  - 289,000 Btu/ton
  - 3.3 kWh/ton
- Average Haul Distance
  - ~22 miles by truck
- 5% Binder Content
- No RAP

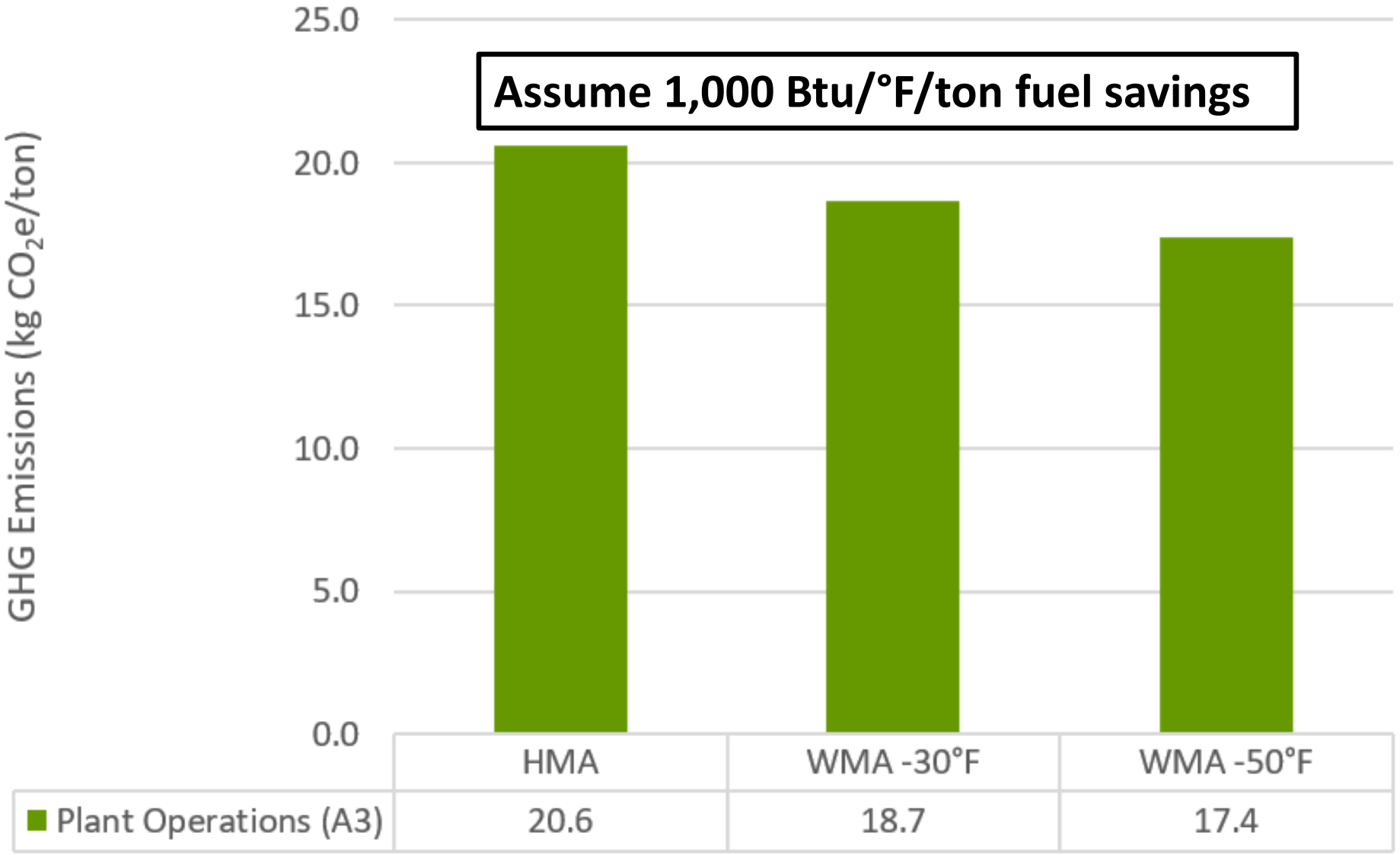


Use of RAP

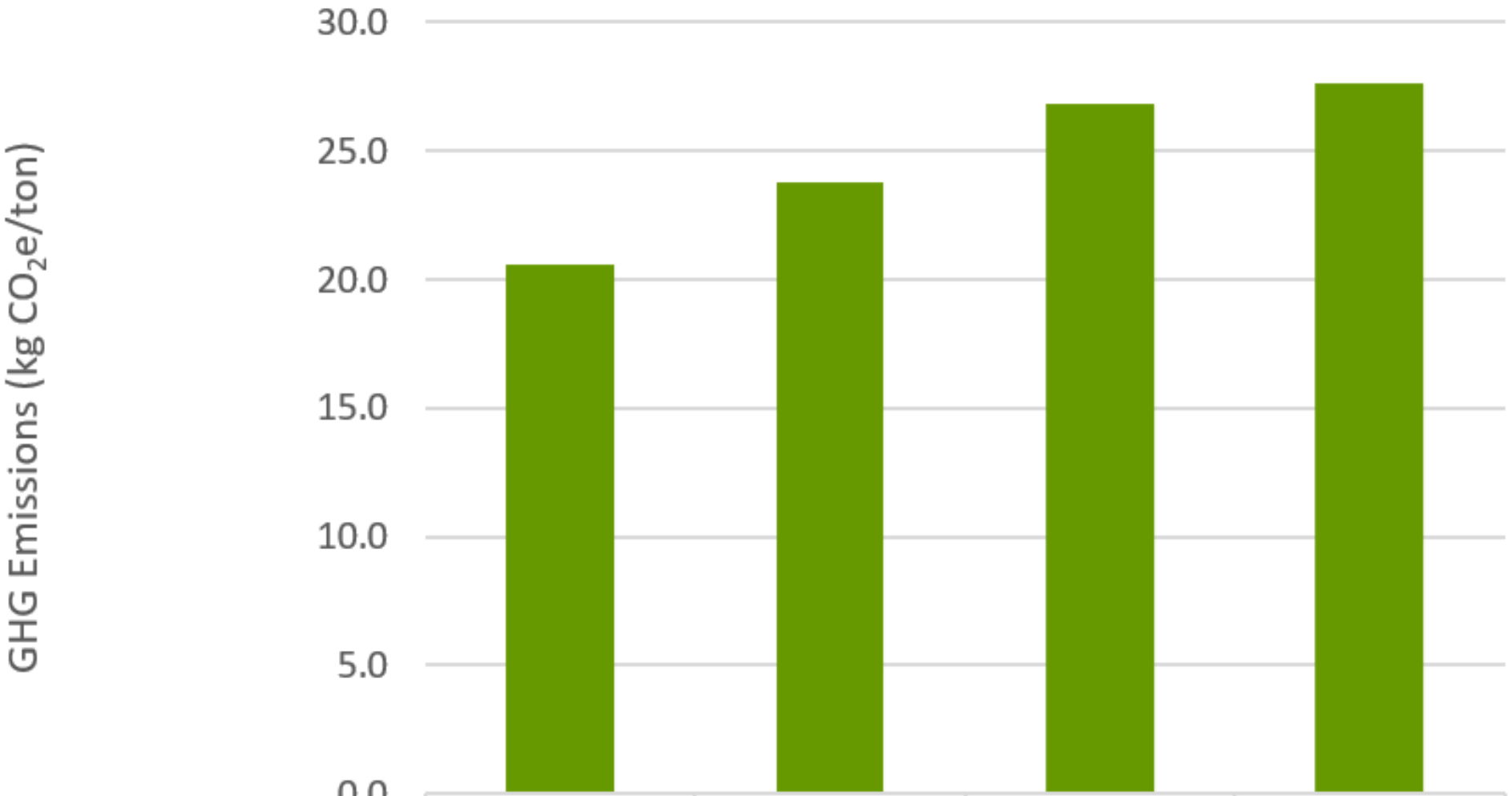


	No RAP	20% RAP	50% RAP
Total (A1-A3)	53.7	47.4	38.0
Plant Operations (A3)	20.6	20.6	20.6
Transportation (A2)	2.8	2.5	1.9
Materials (A1)	30.3	24.4	15.5

Reduced Mix Production Temperature

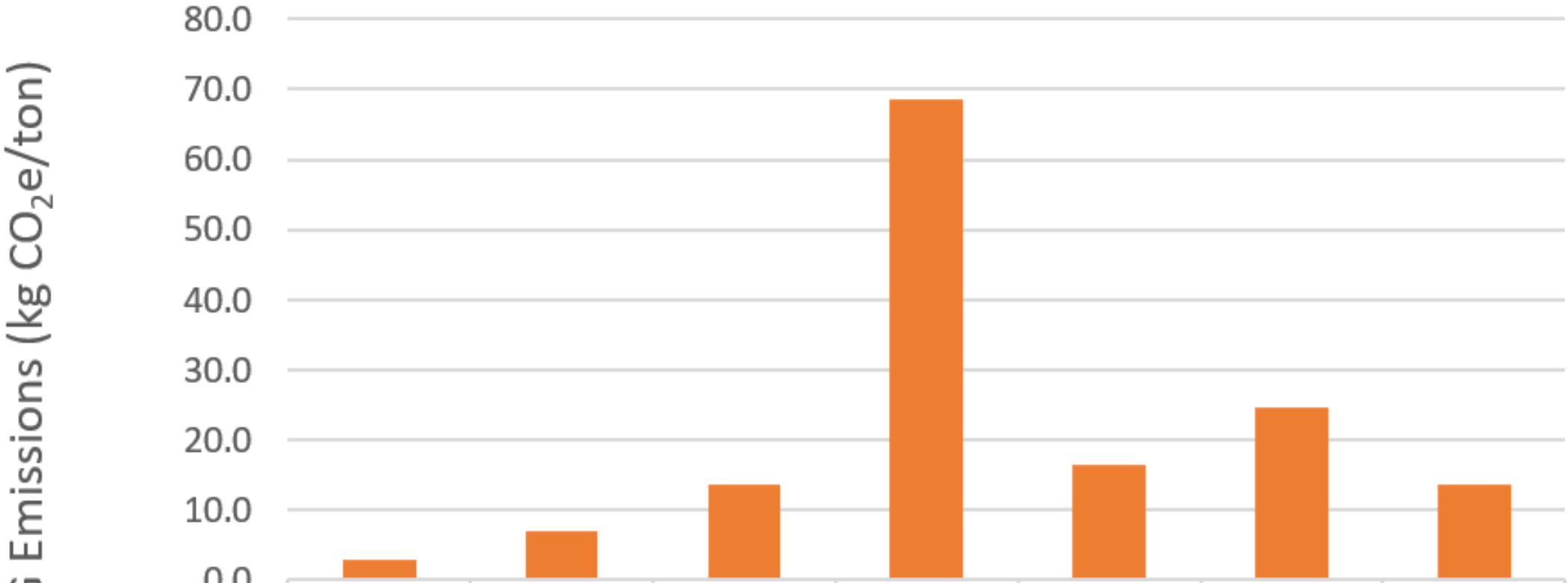


Burner Fuels



	Natural Gas	Used Oil	Propane	Diesel
Plant Operations (A3)	20.6	23.8	26.8	27.6

Aggregate Transport Scenarios



	Average Truck	50 Miles Truck	100 Miles Truck	500 Miles Truck	500 Miles Train	500 Miles Inland Barge	500 Miles Ocean Vessel
Transportation (A2)	2.8	6.9	13.7	68.7	16.3	24.5	13.6

Thank you, Pennsylvania!

Gold Club (50+ Years)

- New Enterprise Stone & Lime Co. Inc.
- Warden Asphalt Co.

30-Plus Club

- Grannas Bros. Stone & Asphalt Co. Inc.
- Joseph McCormick Construction Co. Inc.
- Meeker Equipment Co.
- Riverside Materials Inc.
- Russell Standard Corp.
- Stabler Companies Inc.

Pennsylvania Members

- Abatech
- Allan Myers
- Bishop Brothers Construction
- Blaw-Knox
- Charlestown Paving & Exc., Inc.
- Cumi America Inc.
- Donegal Construction Corp.
- FORTA
- Glenn O. Hawbaker Inc.
- Golden Eagle Construction
- H&K Group
- Highway Equipment Co.
- Liberty Tire Recycling LLC
- Lindy Paving Inc.
- Multitherm, LLC

State Advisor: Owen McCormick, Joseph McCormick Construction Co. Inc.

Thank you, Pennsylvania!

Pennsylvania Members

- Paratherm a division of Lubrizol
- Peter J. Caruso & Sons
- Phoenix Services LLC
- Pine Test Equipment
- Quaker Sales Corp.
- Schlouch Inc.
- Superior Tire & Rubber Corp
- United Employment Associates LLC
- York Building Products

2022 MIDYEAR MEETING

THE RITZ-CARLTON BACARA
SANTA BARBARA
CALIFORNIA

NAPA