NAPA NATIONAL ASPHALT PAVEMENT ASSOCIATION | Emerald ECO LABEL

Comments Received: September 9, 2021 **Responses Finalized:** March 9, 2022	**Document:** Product Category Rules (PCR) for Asphalt Mixes version 2.0 Public Review Draft

No.	Last Name	Page #	Clause/ Sub clause/ Annex/Table/Fig.	Type of Comment (Ed, Sub)	Proposed Revision and/or Comment	Justification for Proposed Revision	NAPA Response/Decision
1	Klutz	13 & 14	3.9.38 and 3.9.42	Sub	3.9.38. hydrated lime a dry white powder consisting essentially of calcium hydroxide (Ca(OH)2) that is added to improve the moisture susceptibility of asphalt mixtures and is processed by adding water to crushed lime (water accounts for approximately 1% of raw hydrate) **See 3.9.42 lime**. 3.9.42. lime ~~A mineral~~ **Calcium oxide (CaO)** derived from heating (calcining) limestone~~, which is added to improve the moisture susceptibility of asphalt mixtures~~. **The term is commonly applied to hydrated lime ($Ca(OH_2)$).**	Current definitions may be a little confusing. Hydrated lime is used as antistrip. The problem is that hydrated lime is commonly referred to as just "lime" in the industry while lime (CaO) is chemically different from hydrated lime ($Ca(OH)_2$). And I don't remember where the 1% water came from. $Ca(OH)_2$ is 76% CaO and 24% H_2O by mass.	Recommend changing the definitions of hydrated lime and lime as follows: 3.9.38. hydrated lime a dry white powder consisting essentially of calcium hydroxide (Ca(OH)2) that is **produced by adding water to crushed lime and is** added to **asphalt mixtures to** improve ~~the~~ moisture susceptibility ~~of asphalt mixtures and is processed by adding water to crushed lime (water accounts for approximately 1% of raw hydrate)~~**; see "lime"**. 3.9.42. lime ~~A mineral~~ **also referred to as quicklime, calcium oxide (CaO) which is** derived from heating (calcining) limestone~~, which is added to improve the moisture susceptibility of asphalt mixtures~~**; the term is commonly applied to hydrated lime ($Ca(OH_2)$), but the materials are chemically distinct from each other.**

Type of Comment	Ed = Editorial Sub = Substantial	NAPA Decision e.g.	Accepted w/Changes Accepted as is Acknowledged but not changed

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2	Hinck	37	7.2.1.3	Sub	Revise the statement regarding internal transportation of RAP and RAS as follows: The transportation distance for RAP and RAS is the distance from the initial RAP or RAS storage or processing location to the asphalt plant. **If the initial processing or storage location is on-site, the transport distance is assumed to be zero. Internal (on-site) transportation of RAP and RAS is accounted for through on-site mobile equipment fuel consumption (see 7.2.1.2).** ~~If RAP or RAS is processed on-site, the internal transportation distance shall be provided.~~	Internal transport of RAP and RAS should be accounted for through on-site mobile equipment fuel consumption. Adding a distance-based calculation will cause this process to be double-counted.	The revision was accepted as proposed.
3	Sheerin	E-4		Ed	Current Text reads: Data Gaps: [This mix uses additives such as fibers, crumb rubbers (if it is added at a plant), liquid antistrips, recycling agents, stabilizers, etc., for which no known public data source exists. The upstream impacts associated with the process of extraction, manufacturing/production, and transportation of the materials listed have not been accounted for in this EPD.] [This mix uses a [polymer/GTR/polymer + GTR] modified asphalt binder. The upstream impacts associated with the process of extraction, manufacturing/production, and transportation of the materials used in the modification process have not been accounted for in this EPD.] It appears that only one GTR process	A more complete standard.	Thank you for the comment. You are correct that upstream data regarding GTR processing is limited. GTR suppliers will need to develop either LCA(s) or EPD(s) that reflect the various GTR manufacturing processes. Prioritization of data and other data requirements for upstream processes is provided in Section 7.1.9.2. NAPA's Roadmap for including LCA data for additives and other specialized mix ingredients is available at https://www.asphaltpavement.org/programs/napa-

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					has any data for the PCR. My comment is what can be done to pull together the other process information required to broaden the EPD to address all the commercially available GTR processes.		programs/emerald-eco-label/product-category-rules.
4	Rouwette	23	7.1.6.1	Sub	Revise the RAP section "*RAP shall be declared as use of SM.*" to separate RAP sourced from end-of-life roads from production waste.	Similar to baghouse fines, distinction should be made between RAP that is sourced from post-consumer or post-industrial sources, and RAP that is recycled on-site. The latter should not count towards Secondary Materials in line with ISO 14021.	The proposed revision was not accepted. Production waste from asphalt plants is de minimis, typically representing less than 5% of RAP utilized at a plant during a given year. Even if all of this production waste is incorporated into the plant's RAP stockpile, this represents less than 1% of the mass of produced mixes for a plant that produces mixes with an average RAP content of 20%.
5	Rouwette	41	7.2.7	Sub	The following clause can have unintended consequences: "*Until upstream datasets adequately account for biogenic carbon uptake and emissions, a negative flow of CO2 should not be assigned to GWP-100 when biogenic CO2 enters the product system through biofuels or bio-based materials. However, there*	The clause is not in line with ISO 21930 as indicated and disadvantages biobased materials at a time when interest in biobased materials is growing. Biobased binders, additives and rejuvenators are likely to become more prevalent in the (near) future. Although I recognize the issue	The proposed revision was partially accepted. Section 7.2.7 was revised to add a biogenic carbon uptake factor for biodiesel, yellow grease, brown grease, and renewable diesel in accordance with the underlying LCA that can be reported as additional

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					should be a positive flow of CO2 to GWP-100 when biogenic CO2 is emitted, such as through the combustion of biofuels. This is a conservative approach that may over-estimate GWP-100, although the impact should be minimal in most cases."	with available public inventories for upstream energy and materials, it would be better if methodological consistency was maintained and NAPA provided corrections or default values for carbon uptake associated with key energy and material sources.	environmental information but not included in the GWP-100 calculation. Section 8.2 was revised to add a new optional subsection: "Biogenic Carbon Uptake Associated with Biofuels That is Not Accounted For in GWP-100" [OPTIONAL] Section 7.2.12 was revised to provide better transparency with respect to biogenic carbon.
6	Rouwette	E-5	Note below table	Sub	Consider revising the statement: "*The impact scores for GWP-100 are based on a 100-year time horizon. As prescribed by the PCR for Asphalt Mixtures section 7.2.7, this EPD does not assign a negative flow of CO2 to GWP-100 when biogenic CO2 enters the product system through biofuels or bio-based materials. However, a positive flow of CO2 is assigned to GWP-100 when biogenic CO2 is emitted, such as through the combustion of biofuels. This is a conservative approach that may over-estimate*	See comment 5.	The proposed revision was accepted, and the note for GWP-100 in the EPD Template (Appendix E) was further revised for clarity and to reflect other revisions to the PCR.

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					GWP-100. Bio-based materials tend to be used in small quantities in asphalt mixtures (<1% by weight of the mix) and biofuels are rarely used for asphalt mixture production, so the impacts are low in most cases."		
7	Rouwette	E-8		Sub	Similar to the section "*Greenhouse Gas (GHG) Emission Reductions Associated with Renewable Energy Purchases [OPTIONAL]*", there should be a section "*Greenhouse Gas (GHG) Emission Reductions Associated with Biobased Materials and/or Energy [OPTIONAL]*"	If comment 5 and 6 are not addressed, than adding the optional information on biobased materials would go some way to bridging the gap between biobased and non-biobased materials and energy sources.	The proposed revision was partially accepted. See response to Comment #5.
8	Rouwette	Annex 1-9	References	Ed	Link to Mukherjee (2016) takes you to the Emerald Eco-label program, not to the document.	Correct link is: https://www.asphaltpavement.org/uploads/documents/EPD_Program/LCA_final.pdf	The revision was accepted as proposed.
9	Rouwette	Annex 1-9	References	Ed	Link to Wildnauer (2019) doesn't work http://www.asphaltinstitute.org/engineering/lca-study-on-asphalt-binders/	Correct link is: https://www.asphaltinstitute.org/engineering/life-cycle-assessment-of-asphalt-binder/	The revision was accepted as proposed.
10	Macri	15	3.9.52	Ed	*Reconsider label for EPD:* ***3.9.52. product specific EPD*** *EPD for a specific mix design or job-mix formula produced by a single asphalt plant that meets the requirements of a given*	While the definition here describes what a product specific EPD means in the context of this PCR, other definitions for "product specific EPDs" exist. The Carbon Leadership Forum recently	The proposed revision was accepted with modifications. The definition of product-specific EPD was revised to be more consistent to the CLF report. A new definition

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					specification, developed by a manufacturer for a specific asphalt mixture plant.	published a white paper discussing different EPD requirements in procurement policies and explains that Product EPDs, "represent the impacts for a specific product and *manufacturer across multiple facilities*." [italics added] https://carbonleadershipforum.org/epd-requirements-in-procurement-policies/ The PCR Committee may want to consider modifying the nomenclature of the term (for example "product-facility specific EPD") to be more precise to avoid confusion in how it is interpreted by others when referenced elsewhere.	for facility-specific EPD was also added. Sections 1.1 and 5.3 were also revised to clarify that this PCR is intended only for facility-specific EPDs and industry average EPDs as defined in Section 3.9. Also, Section 7.1.9.2 was revised to indicate that the first priority for upstream data includes both product-specific and facility-specific EPDs.
11	Macri	44 67 (E-5) 70 (E-8)	Table 6 Table Table	Ed	Revise statements as follows: *Global warming potential (location-based accounting method)* *Global warming potential, incl. biogenic CO2 (location-based accounting method)*	Both location-based and market-based accounting methods are considered appropriate for reporting GHG footprints. This PCR, however, prescribes GWP to be reported using location-based accounting methods in the main sections and that market-	The proposed revision was partially accepted. A footnote was added to the Table in Section 7.3 and the table on page E-5 to indicate that the location-based accounting method is used for transparency.

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					GHG emission reduction from renewable energy purchases (location-based accounting method) *GHG emission reduction from renewable energy purchases (market-based accounting method)*	based methods can be provided in the Additional Environmental Information section. Whenever GWP is referenced on the PCR or EPD we would recommend making clear whether the value was determined using location or market-based mechanisms to avoid misinterpretation or misappropriation from the purchaser or manufacturer.	Also, the table for renewable energy purchases in Appendix E was revised as proposed.
12	Macri	82 (A-8)	Table 2	Sub	*Consider finding a better source (if one exists) for landfill gas and RNG values:* *Landfill Gas: Natural gas, combusted in industrial boiler (proxy)* *Natural Gas: Natural gas, combusted in industrial boiler* *Renewable Natural Gas, combusted in industrial boiler (proxy)*	The required background inventories for landfill gas and renewable natural gas both reference the same data source: conventional non-renewable natural gas. In cases where a plant procures RNG or LG, the EPD would not reflect the reductions associated with these fuel sources. We recognize that national level values for specific types of fuel are lacking but would be supportive of their inclusion in the PCR in the future if they	Thank you for the comment. NAPA intends to revise the datasets in Annex 1 when new life cycle inventory data become available that better characterizes the upstream impacts associated with biofuels.

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						are developed.	
13	Macri	65	E-3	Sub	*Revise statement as follows:* *Production (A3): This stage comprises plant operations involved in the production of asphalt mixtures, including generation of electricity and heat used during asphalt mix production (e.g., extraction, refining, and transport of fuels). Data for this stage is plant specific. Data used to inform this EPD reflect plant operations from [insert reporting period date] (i.e. October 2018-September 2019)*	Parts of the PCR explain that an EPD could be based on plant specific data that is close to ten years old. EPDs are intended to create transparency on the environmental impacts of a product and purchasers may want to assess the timeliness of the underlying data of the environmental claims. Consider requiring the reporting period for A3 data to help increase transparency.	The proposed revision was partially accepted. The data collection period was added to the first page of the EPD Template.
14	Macri				Consider revising statements as follows: *Time period: Plant-specific datasets associated with asphalt mixture production (A3) shall include 12 consecutive months of data with an end date no earlier than beginning in ~~2017~~ 2021 or thereafter…..* *This PCR specifies that all EPDs expire when the PCR expires. Therefore, a mix producer who*	While allowing manufacturers to use older A3 data will help make it easier to quickly create EPDs for new mixes, the current text would allow EPDs that are published a few years from now to rely on plant specific data that is close to 10 years old and may not accurately characterize the embodied carbon or other environmental attributes of the product. In cases where a purchaser requests EPDs from	The proposed revision was not accepted. The added transparency regarding the time period for plant data provided in response to comment 13 sufficiently addresses the concern regarding temporal representativeness of the data in a manner that is consistent with the period of validity allowed by ISO 21930 and prescribed by other PCRs.

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					publishes an EPD in 2026 may, for example, use foreground (primary) data from ~~2017~~ 2021. However, that EPD will only be valid until January 2027. Thus, the temporal representativeness of the data is no different from an EPD that is published in 2022 and is valid until January 2027. This reflects and supports the practice of using software-based tools to develop EPDs in which plant-specific data need not be updated as EPDs for new asphalt mixtures are developed.	several sources, it's likely the mix parameters, and as such A1 impacts, would be similar between the EPDs. The A3 impacts from plant specific data would be a distinguishing factor for comparison and should rely recent data to the extent possible. An alternative to the proposed revision could be to use "Plant-specific datasets associated with asphalt mixture production (A3) shall include 12 consecutive months of data with an end date no earlier than five years from the year in which an EPD will be published ~~beginning in 2017~~. This would mean, for example, any EPDs published in 2023 would need to use underlying data from a reporting period that ends no earlier than 2018.	
15	Macri	34	Electricity Consumption	Sub	Consider revising statement as follows: *Line power consumption in kWh and ZIP code or postal code to*	It's not clear whether the underlying model accounts for this but there are benefits for reporting onsite renewable energy and grid delivered	The proposed revision was not accepted. Although renewable energy that is produced and consumed on-site does not

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					identify the balancing authority in which the plant is located. Asphalt plants with on-site renewable power generation (solar or wind) should report power consumption purchased from the utility and gross power consumption consumed from any on-site renewable energy generation. Deduct excess electricity from on-site renewable generation that is sold or transferred offsite. ~~*report gross power consumption before any reductions from on-site renewable energy generation*~~*. Any offsets or reductions in electricity consumption from on-site renewable energy generation should be reported separately as GHG emission reductions associated with renewable energy purchases in accordance with Section 8.2.1.*	energy separately. Onsite generated renewable energy does not incur any transmission and distribution losses whereas grid procured electricity does. As such reporting these energy sources separately results in less "source" energy from any sites that have onsite renewables.	incur any line loss through power transmission, this energy savings is only realized when the timing of on-site production and consumption are in sync. To our knowledge, there is no established methodology or guidance on how PCRs should quantify the effect that timing of on-site renewable energy production and consumption has on total energy consumption. Typical transmission line loss is in the range of 7-9% or less, and electricity consumption is less than 10% of asphalt mixture production energy, which translates to a contribution of less than 1% of total energy consumed by an asphalt plant (module A3). Thus, the approach adopted in this PCR is conservative, but any overestimates of energy consumption will be negligible. https://www.eia.gov/tools/faqs/faq.php?id=105&t=3

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16	Macri	59	C-1	Sub	Revise as follows: *U.S. EPA ENERGY STAR Program*	ENERGY STAR is a program administered by the U.S. EPA.	The proposed revision was accepted.
17	Macri	65	E-3	Sub	Consider revising statement as follows: *All upstream data sources are prescribed in the Product Category Rules (PCR) and are publicly available and freely accessible to enhance transparency and comparability [with the exception of (insert flow name and cite its source)]*	Section 7.1.9.2 discusses the ability to use primary data for background flows when such data exists. The statement on this page currently doesn't allow for that option.	The proposed revision was not accepted. EPDs for upstream materials are inherently publicly available and freely accessible. Adding information regarding specific flows for which upstream data are derived from facility- or product-specific EPDs not listed in Annex 1 will add unnecessary complexity and, in some cases, may compromise proprietary information regarding asphalt mixture ingredients.
18	Macri	65	E-3 Text in green box	Sub	Consider revising statement as follows: *Further Explanation — Choice of Data Sources Data sources prescribed are publicly available and freely accessible to ensure transparency. Use of the prescribed data source will improve comparability among*	Section 7.1.9.2 discusses the ability to use primary data for background flows when such data exists. Yet Annex 1 does not reference that datasets other than the ones listed in the Annex can be used.	The proposed revision was partially accepted. It should be noted that this comment applies to page 3 of Annex 1. The prioritization scheme for upstream data was added to Annex 1 by creating Section 1.1 of the Annex.

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					EPDs developed using this PCR by limiting variability due to differences in the upstream data within the system boundary. *Alternative data sources for the production of commodities or raw materials, other than the ones listed below, may be used in accordance with Section 7.1.9.2 of the PCR. Any upstream flows differ from the ones below must be cited in the corresponding EPD.*		
19	Macri	47	8.3.2.1	Sub	Revise statement to: *Website link to a www.epa.gov or www.energystar.gov webpage that shows whether a plant has received ENERGY STAR certification. The recommended link at the time of publishing this PCR is www.energystar.gov/buildinglist. ~~documentation that the company achieved ENERGY STAR certification~~.*	PCR should clarify that the organization/program that provides this recognition should be the verification source. Also ENERGY STAR certifies plants, not companies.	The revision was accepted as proposed.

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20	Macri	48	8.3.2.3	Sub	*Website link to a www.epa.gov or www.energystar.gov webpage that shows whether a plant has achieved the Challenge for Industry. The recommended link at the time of publishing this PCR is https://www.energystar.gov/industrial_plants/earn-recognition/energy-star-challenge-industry/challenge-achieved" ~~to documentation that the company achieved ENERGY STAR Challenge for Industry~~*	PCR should clarify that the organization/program that provides this recognition should be the verification source. Also plants, not companies, can achieve the Challenge for Industry.	The revision was accepted as proposed
21	Macri	48	8.3.2.4	Sub	Revise statement to: *Website link to an www.epa.gov or www.energystar.gov webpage that demonstrates the year a company has achieved Partner of the Year award. The recommended link at the time of publishing the PCR is https://www.energystar.gov/about/awards or https://www.energystar.gov/pa*	PCR should clarify that the organization/program that provides this recognition should be the verification source.	The revision was accepted as proposed

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					rtner_resources/partner_list/ci_partner_list" ~~to documentation that the company achieved ENERGY STAR Partner of the Year Award.~~		
22	Macri	47	8.3.2.2	Sub	Revise statement as follows: *ENERGY STAR Energy Performance Scores measure how efficiently a manufacturing plant ~~produces its products~~ operates when compared to similar plants, using a 1-100 scale.*	This edit is to more effectively describe what ENERGY STAR scores measure.	The revision was accepted as proposed.
23	Macri	71	E-9	Sub	Revise statement as follows: *ENERGY STAR Energy Performance Scores measure how efficiently a manufacturing plant ~~produces its products~~ operates when compared to similar plants on a 1-100 scale. A score of 50 reflects average performance, 1 reflects lowest performance, and 100 reflects highest*	This edit is to more effectively describe what ENERGY STAR scores measure.	The revision was accepted as proposed.

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					performance.		
24	Macri	9	1.1 Scope	Sub	Where product types outside of this scope are listed, add reference to those PCRs, where they exist.	This would facilitate users in identifying other PCRs and further educate the building and construction sector.	The proposed revision was not accepted. It's not necessary to list PCRs for products that are not covered by this PCR. Other resources are available to provide this service, such as the North American PCR Catalog, which is available at https://programoperators.org/.
25	Macri		General		There was some confusion about the branding of the PCR as the "Emerald Eco Label" Product Category Rule. Would the PCR only apply to EPDs that are generated through the Emerald Ecolabel software? Or could it and should it be applied used by manufacturers who are developing EPDs independent from the software? Similarly could the term Emerald Ecolabel be interpreted by some to connote environmental performance, rather than simply a tool that conveys performance? If so may want to consider how this is conveyed.		We understand the potential confusion and have removed the Emerald Eco-Label brand from the PCR.
26	Church	Ma	Through	Ed	You have three definitions	This will help readers	The proposed revisions were

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		ny	out		"Central Cold Plant Recycling" "Cold Mix Asphalt" and "Cold-Produced Asphalt Mixture" for what appears to be the same material	understand the specific material you are talking about	accepted with changes. "Cold-mix" was deleted from the description of what is not included in the scope in Section 1.1. Revised the phrase in the EPD template to "cold central plant recycling (CCPR) produced asphalt mixture".
27	Church	11	3.9.17	Sub	You define "cutback asphalt" as an asphalt mixture. However, you only define asphalt foam and emulsified asphalt as potential binders for CCPR. Why do you not include cutback asphalts as an option?	Cutback asphalts are used in cold mix and should be included as a potential binding agent.	The comment did not include a specific proposed revision. The definition of asphalt mixture was revised to clarify the intended meaning: "a plant-produced composite material consisting of ~~aggregates and~~ asphalt binder, emulsified asphalt, or cutback asphalt and aggregates; the mixture ~~that~~ may also include other materials."
28	Church	12	3.9.32	Sub	Your definition of foamed asphalt includes both a technical definition and benefits, but earlier, your definition of emulsified asphalt only includes a technical definition with no benefits. The same benefits you	Definitions should not provide potential benefits, just definitions.	The proposed revision was accepted with changes. See response to comment 73.

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					describe for asphalt foam can be applied to emulsified asphalt.		
29	Church	27	7.1.7.2.4	Sub	You mention “impacts associated with regionalized production” by you never discuss these impacts nor which regions are defining. In addition, you do not have any guidance on how production is potentially influenced by different climates.	This will help users understand which region their company is in and specific impacts that will results	The comment is acknowledged but no changes were made to Section 7.1.7.2.4. The statement regarding “regionalized production” refers to production of electricity. This is further clarified in Section 7.1.9.2 as being regionalized at the balancing authority level.
30	Church	29	7.1.8.1	Sub	You state here that there are data gaps for asphalt emulsions, however, you do not state that there are data gaps for asphalt foam. This is confusing, as there is no indication that there is more data for asphalt foam than asphalt emulsion.	Users need to know if the proper data exists for the binding agent they are using.	The comment is acknowledged but no changes were made to Section 7.1.8.1. In general, data gaps do not exist for foamed asphalt per se. Some foamed asphalt processes involve the use of warm-mix additives (such as zeolite), which is listed as a data gap in Annex 1. Foaming processes that inject water into the asphalt binder without other additives do not have a data gap. It should be noted that consumption of fresh water is included as a resource use indicator in the EPD.

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31	Church	30	7.1.8.1	Sub	You state "In general, this sub-category PCR discourages the use of proxy data when data gaps exist for the upstream impacts of raw material extraction and manufacturing. Proxy data shall not be used unless specifically authorized in Annex 1." This is a very unusual statement in a PCR	PCRs generally allow for proxy data to be used.	The comment is acknowledged but no changes were made to Section 7.1.8.1. The use of proxy data without careful consideration of product-specific variables can be misleading. In general, our approach is to clearly disclose any relevant data gaps and let the owners (agencies) decide whether they will accept EPDs with data gaps. We feel this is the best way to motivate and incentivize additive suppliers to publish data such as life cycle inventories, life cycle assessments, or EPDs for their products. Using an "acceptable" but low-quality proxy that may underestimate their impacts will not incentivize upstream manufacturers to publish their data.
32	Church	34	7.2.1.2	Sub	You state that "utility consumption may be allocated according to the company's established allocation procedures used for financial accounting purposes".	This is highly uncommon to tie accounting purposes to utility consumption.	The comment is acknowledged but no changes were made to Section 7.2.1.2. Economic allocation of processes that produce

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							multiple products is commonly accepted in the practice of LCA (see ISO 14044). Here, we are simply linking the organization's established accounting procedures to this economic allocation process.
33	Church	38	7.2.1.3	Sub	Production temperatures are not used to separately allocate energy inputs into HMA and WMA mixtures	If energy is being allocated based on mixture type, there should be guidance on temperatures for HMA vs WMA	The comment is acknowledged but no changes were made to Section 7.2.1.3. Allocation procedures are described in Section 7.2.5.2, which explains the rationale for not allocating resource use inputs to HMA and WMA mixtures on the basis of production temperatures.
34	Church	39	7.2.4	Sub	You state that there are no burdens allocated to waste materials or co-products. It is not clear how this statement can be made	Most PCRs allocate for waste materials and co-products	The comment is acknowledged but no changes were made to Section 7.2.4. ISO 21930, Section 7.1.2.7 requires that no burdens are allocated to waste materials. Extending this approach to also include co-products is a conservative approach that ensures energy inputs are appropriately attributed to asphalt mixtures produced

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							and sold by the plant. Energy and other resource inputs should not be allocated to waste materials or co-products produced by the asphalt plant, such as baghouse fines and start-up/shut-down waste.
35	Church	40	7.2.5.2	Sub	The only explanation of CCPR is that it can run through a plant without heat, but there is no mention as to the type of plant (pugmill, drum) or whether the plant is specifically designed for CCPR, or if it is an HMA plant adapted to CCPR.	Users need to know if their CCPR set-up can fall under this PCR	The proposed revision was accepted. The CCPR paragraph in Section 7.2.5.2 was revised as follows: "CCPR mixtures can be produced in a purpose-built plant such as a pugmill that only produces CCPR mixtures…"
36	Crews – AEMA/ITC	12	3.9 "Terms specific to the PCR for Asphalt Mixtures"	Sub	3.9.26. emulsified asphalt – (1) a suspension of minute (typically < 100 microns diameter) globules…..*as written*…*but add*…and conforming to standard specifications for use in the production of asphalt mixtures for pavement construction (Sources: ASTM D8-21 and D977-19a) Also note: the phrase "emulsified asphalt" may be used interchangeably with "asphalt emulsion."	A clearer definition with direct relevance to cold asphalt mixtures for **paving** applications and supported by standards.	The proposed revision was accepted with minor changes. See the response to Comment 72.
37	Crews –	12	3.9	Sub	3.9.32 foamed asphalt – Asphalt	The definition is supposed to	The proposed revision was

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	AEMA/ITC				binder, which has been combined with water via direct injection or by treatment with wet sand or water-liberating minerals like zeolite, to form foam, which depending on a number of factors, such as bitumen composition, surface tension, temperature, quantity of water, steam droplet size distribution, and atmospheric conditions, may display half-life and expansion ratio properties suitable for production of asphalt mixtures at ambient temperatures. (Source: Newcomb, D.E., et.al., NCHRP Report 807, Properties of Foamed Asphalt for Warm Mix Asphalt Applications, 2015)	be for foamed asphalt. The definition given in the Draft PCR, however, was more an imprecise description of the layman's MECHANISM typically given to explain how a foam (of the proper half-life and expansion ratio properties) can be used to make a paving mixture. Additionally, words like "tiny," "small," and "trapped" are vague and potentially misleading. The definition, as it was presented in the Draft, sounds more like a publicity ad than a technical definition.	accepted with minor changes. See response to Comment 73.
38	Crews – AEMA/ITC	14	3.9 "Term specific to the PCR for Asphalt Mixtures"	Sub	3.9.42. lime – this should be removed.	It is imprecise and redundant. The word, "lime," as used in the paving industry, almost exclusively means "hydrated lime." Hydrated lime is described adequately in 3.9.38. If a distinction is desired for "quicklime" or CaO, then such a definition should be given.	The comment is acknowledged but the definition of lime was not removed. See response to Comment 1.
39	Crews – AEMA/ITC	15	3.9 "Term	Sub	3.9.59. rejuvenator – A term used to describe substances	Again, as in the definition of "foamed asphalt," this	The comment is acknowledged. The definition

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			specific to the PCR for Asphalt Mixtures"		(such as vegetable oils, fatty acids, petroleum products, and derivatives thereof) which when added to bitumen reduce the stiffness of the binder as measured by AASHTO M 320 and expressed as, for example, a lower PG grade than the starting, un-treated bitumen. When binders doped with such substances yield empirical data that indicate a reduction in the rate of embrittlement with age (empirical data such as the change in the log of the Glover-Rowe parameter with multiple PAV hours), our industry vernacular applies the term "rejuvenator."	definition of "rejuvenator" is more of an idealized description of what our industry would like a "rejuvenator" to be as opposed to a softener. The phrase "partially restore chemical balance" is vague and ungrounded in a technical definition itself. How is "chemical balance" measured. The phrase "aging sensitivity" also is fraught with vagueness and a nonexistent technical method for measurement. This definition, as it was presented in the Draft, sounds more like a sales ad than a technical definition with an empirical basis (similar to the case of "foamed asphalt" above). By the current definition, a lighter/higher penetration grade or lower PG grade asphalt binder would qualify as a rejuvenator.	of "rejuvenator" was revised as proposed in Comment 75.
40	Crews – AEMA/ITC	29	7.1.8.1.	Sub	Add: Recycling agents, rejuvenators, and **softeners**	"Softeners" are defined previously and should also require a data gap, if no reliable upstream LCI data are available.	The revision was accepted as proposed.

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41	Crews – AEMA/ITC	34	7.2.1.2.	Sub	Add this last sentence of the first paragraph: "See also, "Cold Central Plant Recycling (CCPR), page 40, for further explanation of segregating burner fuel consumption from WMA and HMA."	Provides the reader with the knowledge that further explanations about segregating burner fuel consumption will be given.	The proposed revision was accepted with changes. Section 7.2.5.2 was referenced instead of Page 40.
42	Crews – AEMA/ITC	55	References	Sub	Add these references (which were given above). ASTM D977-19a, *Standard Specification for Emulsified Asphalt*. Newcomb, D.E., et.al., NCHRP Report 807, Properties of Foamed Asphalt for Warm Mix Asphalt Applications, 2015)	For completeness.	The proposed revision was accepted with changes to utilize the suggested citation provided in NCHRP Report 807.
43	Crews – AEMA/ITC	E-2	Component Table	Sub	Add a row for the Component, "Asphalt Emulsion" Add the following under Material, "Asphalt Binder, Emulsifier, Water"	Asphalt Emulsions should be referenced in this Product Ingredients table as without them how can CCPR be included.	The proposed revision was accepted with minor revision. See response to Comment 79.
44	Crews – AEMA/ITC	Annex 1-4	2.1.3	Sub	Remove the word, "binder."	The Draft only describes and defines "emulsified asphalt." The word "binder" is redundant in this case.	The revision was accepted as proposed.
45	Dalkie	19	5.3	Sub	Therefore, product specific EPDs shall not be based on a representative or average mix design produced by a single	This clause and additional clarifying language is overly restrictive when defining a product specific EPD and the	The comment is acknowledged but the proposed changes were not made to Section 5.3. Sections

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					asphalt plant. Additionally, this PCR is not intended for development of an average EPD for a group of asphalt mixtures produced by a single asphalt plant ~~or~~ but may be used to develop an average for the same asphalt mixture produced by multiple plants owned by the same company in the same market area. ~~Only~~ ~~industry~~ Industry average EPDs (as defined in Section 3.9) are permitted~~allowed~~.	related exclusions. Following this language, it seems that a new EPD would need to be developed and published for every individual project. This would not allow a "general paving" asphalt mix to be used, e.g. the same mix design from the same plant, but used on different projects, or is it intended that this is permitted? In addition, the same mix design from multiple plants in an operating market may be used to supply larger projects, i.e. cross-shipping. The same averaging criteria can be used in these situations as for developing an Industry Average and there should be no reason to exclude that option for groups of plants of the same mix design, or similar mixes for multiple projects. This aggregation would not preclude the development and supply of project and plant specific EPDs if required. Any averaging and aggregation would need to be specifically	1.1 and 5.3 were clarified to indicate that this PCR is intended for developing facility-specific EPDs and industry average EPDs, but not product-specific EPDs as these terms are defined in Section 3.9. The performance of different plants can vary significantly, even plants located at the same physical site and operated by the same company. Most of the EPD policies that state/local agencies have adopted for asphalt mixtures focus on plant-specific EPDs. Thus, we anticipate relatively few markets where an average EPD for multiple plants owned by the same company, even within the same market area, would be useful to customers.

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						declared in the EPD description.	
46	Dalkie	37	7.2.1.3	Sub	Add bullet: Transport distances shall include empty backhauls.	There is no discussion here regarding short and long haul vehicle selection, or commentary regarding empty backhauls. The treatment of empty backhauls will be dependent on the background LCI dataset used and how that dataset treats backhauls. We understand that the NREL US Federal LCA Commons LCI dataset includes an additional 35% to account for full backhaul. This needs to be detailed in the PCR as to how to treat empty backhauls. Further explanation can be provided to the bullet such as: "Multiply the one way distance by (2/1.35) if using the NREL US LCI dataset." as the NREL data is the suggested default.	Section 7.1.7.2.3 was revised to add a 1.35 multiplier to transportation distances to account for empty backhauls. This is consistent with published data indicating that empty trucks consume nearly half as much fuel as fully loaded trucks (Coyle, 2007), combined with typical industry practices that utilize backhauls to transport materials when favored for economic and logistical considerations. Coyle (2007). Effects of Payload on the Fuel Consumption of Trucks. UK Department for Transport. https://imise.co.uk/wp-content/uploads/2017/09/RR5-Effects-of-Payload-on-the-Fuel-Consumption-of-Trucks.pdf.
47	Braham	8	1.1	Ed	This is the only time you use the term "Cold-Mix" Other placed in the document, you say CCPR, and once you say cold-produced	Nomenclature with treatments can be confusing, so it would be helpful if one term (preferably CCPR, as this is	The proposed revision was accepted with changes. See response to Comment 26.

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						the industry term) is used	
48	Braham	10	3.9.17	Sub	You include “cutback asphalt” in this definition, but then you don’t talk about how cutback asphalt can be used in CCPR.	Just like asphalt emulsion and asphalt foam can be used for CCPR, so can cutbacks. If you decide to remove this term it should be justified, and if you keep it in you should use throughout	The proposed revision was accepted with changes. See response to Comment 27.
49	Braham	12	3.9.32	Sub	In your definition of foamed asphalt you list the benefits, in your definition of emulsified asphalt (3.9.26). The benefits are exactly the same for both, and for cutbacks.	I do not think it is appropriate to have commentary within a definition if it is not applied equally across all definitions.	The proposed revision was accepted with changes. See response to comment 37.
50	Braham	13	3.9.36	Sub	I would suggest updating the definition of HIR using the 2015 Basic Asphalt Recycling Manual (FHWA-HIF-14-001)	I think using a definition that is over 20 years old is not appropriate. The technology has advanced significantly over the past 20 years and the 2015 BARM has a more current and accurate definition.	The definition of HIR was revised as follows: “an ~~on-site,~~ in-place pavement maintenance and rehabilitation method which consists of heating, softening, scarifying, mixing (with rejuvenating oil, rejuvenating emulsion, an ~~soft~~ asphalt binder, new plant-mixed HMA or WMA, and/or new aggregate), placing, and compacting the existing pavement. There are three sub-disciplines: surface recycling, remixing, and repaving. [Source: Basic Asphalt Recycling Manual,

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							modified for clarity and brevity]"
51	Braham	22	7.1.4	Ed	Should define RSL	Unknown acronym	The proposed revision was partially accepted. RSL is defined in ISO 21930, which is incorporated by reference. RSL was added to the list of abbreviated terms in Section 4.
52	Braham	29	7.1.8.1	Sub	Why was it deemed that asphalt emulsion had data gaps, but asphalt foam did not?	I do not see any indication that more work was completed for asphalt foam versus asphalt emulsion, therefore, I would expect there to be data gaps for both of these materials.	The comment is acknowledged but no changes were made. Foaming processes that involve the direct injection of water into asphalt are not a data gap because consumption of fresh water is accounted for in the EPD. Foaming processes that involve the use of additives such as zeolite would be a data gap. This is accounted for in Section 7.1.8.1 under the category of warm-mix additives and indicated in Table 1 of Annex 1.
53	Braham	37	7.2.1.3	Sub	Why isn't asphalt foam listed as a raw material input? I assume it is because you will use the asphalt binder as the raw input, and freshwater, but shouldn't this	It seems that not all materials are being accounted for here, especially with CCPR	The proposed revision was partially accepted. Consumption of freshwater is accounted for as plant-

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					somehow be made clear? I also think cutback should be included as a raw input		specific data in Section 7.2.1.2. and does not need to be listed as an ingredient. The fourth bullet in Section 7.2.1.3 was revised to "Virgin asphalt binder, asphalt emulsion, or cutback asphalt."
54	Braham	37	7.2.1.3	Sub	Shouldn't asphalt emulsion be listed as a raw material input?	It seems that since asphalt binder is a raw material, asphalt emulsion should be listed too. However	The proposed revision was accepted. See response to Comment 53.
55	Braham	43	7.2.13	Sub	Why isn't CCPR listed with WMA production for foaming?	Both use similar technologies, yes? If not, then more differentiation needs to be provided between the two technologies.	The revision was accepted as proposed.
56	Braham	45	8.2.2	Sub	Where did you get the 51 km/32 miles for RAP transportation?	This seems like a very specific number. I would think that the actual transportation range would vary widely based on a host of factors. The justification of providing such a specific number is not clear.	The comment is acknowledged, and minor edits were made. The distance is based on an industry survey that was conducted in 2021, the results of which are presented in the underlying LCA (Mukherjee, 2021). A reference to the LCA was added at the end of this section (now Section 8.2.3). The distance was revised to

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							53 km (33 miles).
57	Braham	45	8.3	Sub	I think the Diamond Achievement discussion should be removed. When you look at the description of the award on NAPA's website, the emphasis is on "improving quality, safety, and excellence" Environmental enhancement is not mentioned in the benefits section, but there is generic reference to environmental practices and efforts in the eligibility section.	Seems odd that this type of award could enhance an EPD, especially since NAPA is paid to provide this achievement.	The comment is acknowledged but no changes were made to Section 8.3: ISO 21930 Section 8.3, provides examples of environmental aspects that maybe included in the EPD as additional environmental information, one of which is "best environmental practice." Examples provided for demonstrating best environmental practice include Type I (self-declared) environmental labels or "other environmental labels." The Diamond Achievement program uses a self-assessment process to evaluate a variety of parameters in and around the plant site, including appearance, operations, environmental practices, safety, permitting and regulatory compliance, and community relations. This is consistent with the "best environmental practice" example specifically identified

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							in ISO 21930 as an example of an environmental aspect that may be included in an EPD.
58	Braham	51	9.2	Sub	I would suggest you add asphalt emulsion grade to the list of optional additional information	If you have performance grade for asphalt binder, why not asphalt emulsion	The revision was accepted as proposed. The list of optional information in Section 9.2 was revised as follows: "The performance grade of the asphalt binder or asphalt emulsion (e.g., PG 64-22).
59	Braham	E-2	n/a	Sub	Add asphalt emulsion, cutback, and asphalt foam to the product ingredients	These are all ingredients for CCPR	The proposed revision was accepted with changes. Asphalt emulsion and cutback asphalt were added to the materials provided in the Product Ingredients table on page E-2. Foamed asphalt is not necessary. Water is a process aid for the foaming process but not an ingredient. Water is accounted for in the Fresh Water Consumption resource use indicator.
60	Braham	E-4	n/a	Sub	The data gap of treating RAS the same as RAP is not appropriate in my opinion. In addition, stating that tear off vs factory is not	RAP and RAS are two very different materials, even within RAS, there are two very different materials. Clumping	The comment is acknowledged but no changes were made.

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					being considered is a huge oversight	all of these together is not appropriate.	The upstream impacts associated with processing RAS for use in asphalt mixtures are similar for end-of-life tear offs and off-spec material from manufacturing, since RAS will be processed using a shredding/grinding machine regardless of the source. This process, although not identical to RAP processing, is similar from a material handling perspective, lending confidence to the use of RAP processing as a proxy for RAS processing. There are significant differences between RAP and RAS that can affect the asphalt binder content and quality. However, these are accounted for in the overall mix design through factors such as the virgin asphalt binder content, performance grade of the binder, and the use of recycling agents. The data gap disclosure on page E-2 regarding RAS was deleted because use of proxy data is not a data gap.
61	Mack	18	5.1.1	Sub	Remove this statement:	To say one can't compare	The proposed revision was

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		& 21 & 51	& 5.5 & 9.2		~~Note: Due to the high level of uncertainty and lack of consensus within the scientific literature associated with modeling use phase impacts of different pavement materials, EPDs for asphalt mixtures should not be compared to EPDs for non-asphaltic pavement materials even within the context of a cradle to grave LCA.~~ While it is recommended to completely strike this statement, if guidance is required, replace it with: <u>Life cycle assessment comparisons of pavement designs may use EPDs produced through this program as a data input. Comparison of life cycle environmental impacts of different pavement designs are valid if</u>	alternative pavement materials in a cradle to grave LCA fundamentally goes against one of the primary reasons to develop an EPD in the first place. 1. While this is a PCR for asphalt, it's not just the asphalt mixtures that is the final product. The final product is the pavement - be it made from different asphalt products or concrete. The fact is the remaining portions of the LCA (e.g. the use phase) are impacted by the difference of performance of different mixes (i.e., different EPDs) and the total pavement LCA will be impacted by this difference in performance. This idea is recognized in several locations throughout the PCR where it says when comparing different asphalt mixtures, the performance differences need to be taken	accepted with changes. The comparability statement has been revised by removing the second half of the statement, beginning with "For example, when comparing a conventional dense graded asphalt mixture…" Sections 5.1.1, 5.5, 9.2, and Appendix E were revised accordingly.

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					similar system boundaries and secondary data sources for all pavement material inputs are used. This replacement language is slightly modified text from the NAPA Asphalt Mixture PCR v1 and provides the needed guidance.	into account with a cradle to grave LCA (see Sec 5.5 Page 21, and Sec 9.1 Page 50, where both paragraphs that begin with “When asphalt mixtures have different…” Therefore, it is inconsistent to use the results to compare different asphalt pavement types but not pavement types of different materials. 2. The PCR only covers Stages A1- A3. The use phase does not impact the EPDs created by this PCR (it’s not backwards flowing). As such, the PCR will still be applicable for vendor selection. 3. The argument for not using the	

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						EPDs to compare different pavement types in a LCA is the uncertainty around the USE PHASE. Ignoring the information / use phase results is not answer. There are other ways to address uncertainty. For example, because LCA's report information for each stage, the Use Phase stages impacts will be reported separately in the LCA and the owner/agency can judge or weight the results as they see fit (much like currently done in a LCCA's with agency cost and user costs).	
62	Mack	30	7.1.2.1	Sub	Revise the Cut off Criteria for Additives. Develop and assign a "predetermined factor" as done in Section 7.2.1.1	While additives are a very small portion of the asphalt mixture by weight, easily below the 1% cut-off, they have an oversized impact. The	The comment is acknowledged but no changes were made to Section 7.1.2.1. . The comment proposes to

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					for RAP, RAS and portable plant weight, to account for additives if not using the LCI data for Asphalt binder, with 8% GTR Asphalt binder, with 0.5% PPA Asphalt binder, with 3.5% SBS from Wildnauer. Use this and other data based on literature to determine "predetermined factor" impacts of Additives and then allow for adjustments based on total shipping distances.	discussion in the PCR does a good job at recognizing this a data gap; but ignoring it is not the issue. The Life Cycle Assessment of Asphalt Binder by Wildnauer, et al reports the difference of HMA/WMA products based due to additives and the use of this source addresses the issue somewhat. However, the recommendation to ignore it and report as a gap creates a bias in the results. An assumed impact that is in the "middle of the road" is better assumption of "no impact," especially when there is data (Wildnauer) that can be used to quantify it	develop predetermined factors for additives with data gaps using data provided in literature, but offers no recommendations regarding which sources to use for which materials. The use of "middle of the road" data does not incentivize additive manufacturers to provide more appropriate data. It should be noted that the additive data provided by Wildnauer et al. is included as a prescribed secondary data source (Annex 1) for SBS copolymer, ground tire rubber, and polyphosphoric acid.
63	Mack	31	7.1.8.3	Sub	Consider keeping "Lubricants" as an item to be accounted for in the EPD.	While the PCR may be correct in that the "annualized quantities are well below the cut-off criteria of 1%", the concrete PCR recommends	The comment is acknowledged but no changes were made to Section 7.1.8.3. One of the goals of the EPD

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						and has lubricants included. In order to create consistency among PCR / EPD of different materials, consider including lubricants.	program is to encourage mix producers to develop and publish EPDs. Adding data collection requirements for materials like lubricants and consumables that account for a vey small percentage (<1%) of the environmental impacts adds unnecessary complexity to the EPD development process.
64	Mack	31	7.1.8.3	Sub	Consider keeping “Consumables” as an item to be accounted for in the EPD.	While consumables between different asphalt products may be different; as discussed in Comment #1, a primary reason to create EPDs is to have the information in order to do an LCA that may be comparing other products. Removing “consumables” creates inconsistencies and has a lack of transparency that has the potential to bias the results when used in an LCA.	The comment is acknowledged but no changes were made to Section 7.1.8.3. See response to Comment 63.
65	Mack	Annex 1-5	Table 1 – Mineral Filler	Ed	Recommend using the 2021 Portland Cement Assn Industry average rather than NREL See https://www.astm.org/CERTIFICA	The PCR should recommend that the most current data is being used. If the NREL (2021) uses the current PCA industry average,	The revision has been accepted as proposed.

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					TION/DOCS/622.EPD_FOR_Portland_Athena_03082021_Final.pdf	this is a mute point. If it is based on old data, it needs to be the newest data source. Please confirm	
66	Mack		Portable Plants		Just wanted to say the way Portable plants were included was very good and a good step forward. Nice Job.		Thank you for the comment.
67	Listberger	41	7.2.7	Sub	Bio-based materials tend to be used in small quantities in asphalt mixtures (<1% by weight of the mix) and biofuels are rarely used for asphalt mixture production; however, the volume of bio-based asphalt additives has seen significant increases in volume over the past decade with much of that volume consisting of vegetable oil-based products. ISO 21930 requires inputs and outputs of biogenic carbon to be fully accounted for on a net-zero basis. ~~However,~~ While the available public inventories for upstream energy and materials specified in Annex I do not adequately account for biogenic carbon uptake and emissions, there should be analysis undertaken, including consideration of existing LCA of	ISO 21930 states that when biogenic carbon enters the product system, this biogenic carbon flow shall be characterized in the LCIA with -1kg CO2E/Kg CO2 of biogenic carbon in the calculation of the GWP, since it represents the removal of carbon that is part of the carbon cycle of bio-based materials. When this bio-based material, partly or as a whole is converted to emissions, by combustion or biodegradation, for example it shall be accounted for as emitted biogenic CO2 and other emission such as biogenic CH4 in the information module where the occur, depending on the end-of-life scenario. Since these	The proposed revision was accepted with changes. The first part of the proposed revision was accepted and edited slightly ("however, the volume of bio-based asphalt additives…"), but not the second part ("there should be analysis taken…"). When additive suppliers provide upstream data for bio-based materials that includes information regarding biogenic carbon, that information will be accounted for in EPDs for asphalt mixtures. See responses to Comments 5 and 7.

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					certain feedstocks, of the net carbon uptake from the production of row crop feedstocks such as soybeans, for example, so that an accurate accounting of biogenic carbon uptake can be reflected. Until upstream datasets that adequately account for biogenic carbon uptake and emissions, a negative flow of CO_2 should not be assigned to GWP-100 when biogenic CO_2 enters the product system through biofuels or bio-based materials. However, there should be a positive flow of CO_2 to GWP-100 when biogenic CO_2 is emitted, such as through the combustion of biofuels. This is a conservative approach that may over-estimate GWP-100, although these errors should be minimal in most cases."	bio-based asphalt additives are not converted into emissions through combustion, they should remain as a -1 kg CO2e/kg CO2. Once the LCA data has been generated for these additives, there should be a mechanism for incorporating the calculated biogenic CO2 into the EPD for the finished asphalt mix. Many ISO Standards reference using the radiocarbon method for determining the ratio of fossil and biogenic carbon in a material, ex. ISO 13833 and ISO 16620. Considerable reductions in emissions have been achieved at the farm level and existing efforts to adopt regenerative agricultural practices that benefit soil health and water quality have also contributed to carbon emissions reductions. A deeper analysis of these farm level emissions reductions achieved will result in more accurate assessments of the emissions reduction	

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						benefits from the use bio-based materials.	
68	Listberger	34	7.2.1.2	Sub	Primary (plant-specific) data must be specific to the plant for which an EPD is being developed. For utilities such as electricity and natural gas, the goal is to collect data that is submetered within the plant at the unit process level. However, utilities are not always submetered at the unit process level (e.g., a plant that consumes natural gas for both the burner and the hot oil heater may only have a single meter that measures total natural gas consumption for the plant). In such cases, it's acceptable to collect utility consumption at the whole plant level rather than the unit process level. The exception to this rule is for conventional asphalt plants that also produce asphalt mixtures at ambient temperature using CCPR technology and/or plants that produce WMA at reduced temperatures, which requires submetering of burner fuel	Warm mix technology is being promoted throughout the industry as a sustainable innovation, however based on the PCR, there is little evidence to show that mixes produced at lower temperatures will have less environmental impacts. By including warm mix production in the submetering exception, it allows contracts who desire to do so, to separately meter their energy usage when producing warm mix.	The comment is acknowledged but no changes were made to Section 7.2.1.2. Subdividing burner fuel consumption for CCPR production is fairly straightforward, since the burner simply does not operate when the plant is producing CCPR. On the other hand, allocating energy consumption based on mix production temperatures is much more complex. Mix production temperatures can vary depending on a variety of factors, including weather conditions (seasonal variations), haul distances, the use of polymer modified asphalt binders, and the use of warm mix technologies. There are no documented data collection and analysis procedures for tracking these variables over a 12-month

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					consumption and electricity to subdivide HMA/~~WMA~~ production from WMA or CCPR production.”		period in a way that can be used to reliably allocate production energy based on mix production temperature.
69	Listberger	17	3.9.69	Sub	3.9.69. Submeter a system for measuring utility usage associated with a given process (e.g. tracking burner fuel consumed during the production of warm mix asphalt.)	In conjunction with comment number 2, this would allow for mix producers to submeter their utilities during the production of warm mix asphalt. Submetering is not defined as having or utilizing a physical meter provided by the utility company, but a merely system for tracking that could be as simple as a spreadsheet that is manually filled out by plant personnel at the start and completion of a warm mix production run at a given plant location.	The proposed revision was not accepted since it is tied to comment 68, which was also not accepted.
70	Redmond	21	5.5	Sub	Not certain what the full logic is behind statement: *EPDs for asphalt mixtures should not be compared to EPDs for non-asphaltic pavement materials even within the context of a cradle to grave LCA.*	*Can you provide additional background (beyond “lack of consensus” or “high level of uncertainty”) or clarity on why comparing EPDs for asphalt mixtures with different pavement materials should not be done.*	The comparability statement has been revised. See response to Comment 61.
71	Ingmire	45	8.2	Sub	Consider allowing for the **optional** reporting of additional impact categories:	Human and eco toxicity are important sustainability considerations warranting	The comment is acknowledged but the suggested revision was not accepted due to the large

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					• TRACI 2.1, Human toxicity, non-canc. – CTUh • TRACI 2.1, Ecotoxicity – CTUe • TRACI 2.1, Human Health Particulate Air – kg PM2.5 eq. TRACI 2.1, Human toxicity, cancer – CTUh	reporting of these impact categories for all products. While toxicity indicators have high uncertainty ranges at present, significant work is being done to pare down this uncertainty as evidenced in three included attachments (Fantke, et al. 2018, Fantke, et al. 2021, and Global LCIA Guidance (GLAM) Phase 3 Scoping Document) and does not preclude such impact categories from being reported. ISO 21930, 8.2 includes the provision to include written discussion of the results and limitations. An example of this is available in the attached Concrete PCR v1.1 (NSF), "Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting these categories."	variability in data quality associated with upstream inventories. The addition of human toxicity and ecotoxicity indicators will be reevaluated as the quality of upstream datasets improves.

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72	Batson	12	3.9.26	Sub	*Revise this statement: emulsified asphalt – (1) a suspension of minute (typically < 100 microns diameter) globules of asphalt material in water or in an aqueous solution and conforming to standard specifications for use in the production of asphalt mixtures for pavement construction, or (2) a suspension of minute globules (typically <100 microns diameter) of water or of an aqueous solution in a liquid asphalt material and conforming to standard specifications for use in the production of asphalt mixtures for pavement construction (Sources: ASTM D8-21 and D977). The phrase "emulsified asphalt" may be used interchangeably with "asphalt emulsion."*	A clearer definition with direct relevance to cold asphalt mixtures for **paving** applications and supported by standards, as stated in ASTM D8-21 and ASTM D977.	The revision was accepted as proposed.
73	Batson	12	3.9.32	Sub	*3.9.32 foamed asphalt ~~asphalt binder that has been combined with a small amount of cold water that turns to steam and becomes trapped in tiny asphalt binder bubbles, creating a thin-film asphalt foam that aids~~*	Foamed asphalt is defined in Newcomb, D.E., et.al., NCHRP Report 807, National Academies of Sciences, Engineering, and Medicine 2015. Properties of Foamed Asphalt for Warm Mix Asphalt Applications. Washington, DC: The National Academies	The proposed revision was accepted with minor changes. The word "bitumen" was replaced with "asphalt binder" to be consistent with the terminology used in the PCR. The phrase "ambient

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					~~*the coating of aggregate with asphalt binder while improving workability and allowing reduction of the temperature at which the asphalt mixture is mixed and placed on the road*~~ *asphalt binder which has been combined with water via direct injection or by treatment with wet sand or water-liberating minerals like zeolite, to form foam, which depending on a number of factors, such as bitumen composition, surface tension, temperature, quantity of water, steam droplet size distribution, and atmospheric conditions, may display half-life and expansion ratio properties suitable for production of asphalt mixtures at ambient temperatures. Source: National Academies of Sciences, Engineering, and Medicine 2015. Properties of Foamed Asphalt for Warm Mix Asphalt Applications. Washington, DC: The National Academies Press. https://doi.org/10.17226/22145*	Press. https://doi.org/10.17226/22145	temperature" was replaced with "reduced temperature."
74	Batson	13	3.9.41	Sub	*3.9.41 landfill gas a byproduct of the decomposition of organic material in landfills,*	Added a note that landfill gas is also a source of renewable natural gas which helps further	The comment is acknowledged. After further review, it was determined that

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					composed of roughly 50 percent methane, 50 percent carbon dioxide, and a small amount of non-methane organic compounds. This is also a source of renewable natural gas, along with other sources such as dairy, wastewater treatment facilities and others to name a few that may have different carbon intensity and GWP scores.	reduce GHG emissions. Source: https://www.rngcoalition.com	*landfill gas* is defined in ISO 21930, which is incorporated into this PCR by reference. The definition of *landfill gas* was removed from this PCR. The definition of RNG (3.9.49) adequately discusses the other potential feedstocks.
75	Batson	15	3.9.59	Sub	*Rejuvenator* *Revise this statement:* *~~A hydrocarbon material that reduces the stiffness and can help to partially restore chemical balance, reduce brittleness, and/or improve aging sensitivity of a blend of virgin and recycled asphalt binder~~* *A recycling agent, as defined in 3.9.58, with strongly polar compounds that help to polarize asphaltene clusters in recycled binders and compatiblize them with maltenes, thus breaking up the large asphaltene clusters. The addition of these strongly polar compounds reduces stiffness and increases the phase angle.*	This definition is more in line with the NCHRP Report 927 explanation of rejuvenators. *NCHRP Research Report 927, Evaluating the Effects of Recycling Agents on Asphalt Mixtures with High RAS and RAP Binder Ratios (2020). http://nap.edu/25749.*	The revised definition was accepted as proposed. Additionally, the definitions of "recycling agent" and "softener" were revised to be more consistent with the usage of these terms in NCHRP Research Report 927. Revised the definition of "recycling agent" to: Additive with chemical and physical characteristics designed to restore the rheological properties of aged asphalt binders in recycled asphalt mixtures. [Source: NCHRP Research Report 927].

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					NCHRP Research Report 927, Evaluating the Effects of Recycling Agents on Asphalt Mixtures with High RAS and RAP Binder Ratios (2020). http://nap.edu/25749.		Revised the definition of "softener" to: A recycling agent, as defined in 3.9.XX, that is distinct from a rejuvenator because it decreases the stiffness of recycled asphalt binder without sufficiently reducing the phase angle [Source: NCHRP Research Report 927].
76	Batson	29	7.1.8.1	Sub	*Revise this statement:* *Recycling agents, ~~and~~ rejuvenators, and softeners*	"Softeners" are defined previously and should also require a data gap, if no reliable upstream LCI data are available.	The revision was accepted as proposed. See also comment 40.
77	Batson	34	7.2.1.2	Sub	*Revise this statement:* *The exception to this rule is for conventional asphalt plants that also produce asphalt mixtures at ambient temperature using CCPR technology, which requires submetering of burner fuel consumption to subdivide HMA/WMA production from CCPR production. See also, "Cold Central Plant Recycling (CCPR), page 40, for further explanation of segregating burner fuel consumption from*	This reference provides the reader with the knowledge that further explanations about segregating burner fuel consumption will be given.	The proposed revision was accepted with changes. See response to Comment 41.

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					WMA and HMA.		
78	Batson	55	References	Sub	*Add these references (which were given above).* *ASTM D977, Standard Specification for Emulsified Asphalt.* *National Academies of Sciences, Engineering, and Medicine 2015. Properties of Foamed Asphalt for Warm Mix Asphalt Applications. Washington, DC: The National Academies Press. https://doi.org/10.17226/22145.* *National Academies of Sciences, Engineering, and Medicine 2020. Evaluating the Effects of Recycling Agents on Asphalt Mixtures with High RAS and RAP Binder Ratios. Washington, DC: The National Academies Press. https://doi.org/10.17226/25749.*	For completeness	The proposed revision was accepted with changes. The references were added using the suggested citation in the publications.
79	Batson	E-2	Component Table	Sub	*Add a row for the Component, "Asphalt Emulsion"* *Material Asphalt Emulsion (If applicable)*	Asphalt Emulsion was omitted from Product Ingredients Table.	The proposed revision was accepted but the term "Binder" is now used for the Component. See also comment 43.

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80	Batson	Annex 1-4	2.1.3	Sub	*Revise this statement:* *emulsified asphalt ~~binder~~*	The definition of "emulsified asphalt" (3.9.26) does not include the word "binder."	The revision was accepted as proposed. See also comment 44.
81	Batson	16	3.9.67	Sub	*Warm Mix Asphalt (WMA) Technologies* *Revise this statement:* *~~Methods that aid compaction of asphalt mixtures and allow asphalt mixtures to be mixed and placed at lower temperatures than conventional asphalt mixtures, e.g., warm-mix additives or foaming~~* *"WMA technologies allow the complete coating of aggregates, placement, and compaction at lower temperatures than conventional HMA. Although the reduction in temperature varies by technology, WMA is generally produced at temperatures ranging from 25°F lower than HMA to the boiling point of water (212°F). Simply put, WMA technologies are aids to workability and compaction." (National Academies of Sciences, Engineering, and Medicine 2014. Field*	This definition is cited here: *National Academies of Sciences, Engineering, and Medicine 2014. Field Performance of Warm Mix Asphalt Technologies. Washington, DC: The National)* *Academies Press. https://doi.org/10.17226/22272 .*	The suggested revision was accepted with changes. The definition of WMA technologies was revised as follows: "technologies, including the use of warm mix additives and asphalt binder foaming processes, that reduce the temperature needed to produce and compact asphalt mixtures for the construction of pavements. [Source: FHWA. Warm Mix Asphalt FAQs. Modified for clarity and brevity. https://www.fhwa.dot.gov/innovation/everydaycounts/edc-1/wma-faqs.cfm#wma.

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					Performance of Warm Mix Asphalt Technologies. Washington, DC: The National) Academies Press. https://doi.org/10.17226/22272.		
82	Batson	30	7.1.8.1	Sub	*Revise this statement:* *An alternative minimum threshold for binder additives with no available upstream (background) data or proxy data is ~~0.1%~~ 0.000% of the asphalt binder by mass to be declared on the EPD as a data gap as prescribed in Section 9.*	If the intent of the document is to protect the environment, the additive minima should be 0. There could be potentially hazardous materials being used in asphalt mixtures that are not accounted for in this process.	The comment is acknowledged but no changes were made to Section 7.1.8.1. The last paragraph of Section 7.1.8.1 states that regulated hazardous substances shall be declared regardless of weight. This addresses the commentor's concern about hazardous materials at very low concentrations.
83	Batson	18	5.2.2	Ed	*In general, we would like to see the PCR for Asphalt Mixtures expand the scope of the life cycle stages beyond A3. We would like to recommend a section that would state that as data becomes available, the committee will amend the PCR to show energy savings based on extension of the road life.*	FlexPave, TxME, and AASHTO Pavement ME models using field data show that by reducing temperatures 30-40°F, the service life of the road can be extended 20-30% percent. (See Attachment 1). Polymer modified asphalts will show similar service life extension through the use phase. Additionally, the PCR as	The comment is acknowledged but no changes were made to Section 5.2.2. Per ISO 21930, functional performance of a construction product is identified in terms of the functional unit, which is not defined in this PCR. When an EPD is used as input data for a pavement LCA study, mix performance can be considered in terms of the functional unit defined in

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						written to the gate (A3) does not accurately anticipate the potential unintended consequences of other recycled materials' long- term impacts on pavement life. Using the current methodology, both warm mix asphalt additives and polymer modified asphalts will likely result in higher EPD/GWP scores than conventional hot mix asphalt mixtures. Warm mix asphalt additives and elastomeric polymers are unfairly penalized whereas recycled materials will benefit from this A1-A3 approach. Through all stages of the pavement life cycle (A-D), service life has a first-order impact on emissions. Extended service life of the road has the effect of reducing the mix tons required per lane mile per year which reduces the GWP of a road on an emissions per lane mile per year basis. For EPDs to serve	the LCA.

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						as an effective tool to describe the emissions impact of pavement mixtures, positive and/or negative impacts must be incorporated in the final EPD. In the interim, using a cradle to gate approach, this could be done with a performance factor.	
84	Batson	29	7.1.8.1	Ed	*How would any non-bituminous material supplier get its environmental impact data into the Emerald Eco-Label EPD if it does not go through a public database like TRACI?*		In response to the comment, Section 7.1.9.2 establishes the prioritization of data for upstream processes. Additionally, NAPA has published a roadmap for integrating upstream data into the Emerald Eco-Label program. See https://www.asphaltpavement.org/programs/napa-programs/emerald-eco-label/product-category-rules
85	Batson	29	7.1.8.1	Sub	*Mineral filler*	Add bullet point for mineral filler for completeness.	The comment is acknowledged but no changes were made. Mineral fillers are not identified as data gaps in Table 1 of Annex 1.
86	Batson	31	7.1.9.1	Ed	*Time period* *How will contractor data be included if the paving season they operate within is less than*		In response to the comment, the requirement for 12 consecutive months of data does not require that the plant

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					12 consecutive months? *Is there an alternative way to submit data if a contractor's paving season is less than 12 consecutive months?*		operate in each of the 12 months. Plants that shut down for the winter may have base loads of energy consumption during some or all of the winter months. The 12-month data collection period ensures that these base loads are accounted for.
87	Batson	Appendix E-1	Product Description	Sub	*Add disclaimer after temperature range of XX to XX °C (XX to XX°F)* *energy savings from reduced warm mix temperatures may not be accounted for in the results.*	Actual A3 energies and GWP value may be lower than value reported on the EPD due to equal energy allocation for WMA and HMA.	The proposed revision was accepted with changes. The language was revised to reflect the situation in which some mixes are produced hotter than the average and some are produced lower than the average: "Energy and environmental impacts are based on a plant's average performance over a 12-month period and are not adjusted for mix-specific production temperatures."
88	Batson	Appendix E-4	Data Gaps	Sub	*Revise this statement:* *[This mix uses additives such as fibers, crumb rubbers (if it is added at a plant), liquid antistrips, recycling agents, stabilizers, recycling agents, stabilizers,*	Warm mix additives are defined but left out of this section.	The proposed revision was accepted with changes. The EPD Template now provides for data gaps to be indicated on the material ingredients table, ensuring

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					warm mix additives, etc., for which no known public data source exists. The upstream impacts associated with the process of extraction, manufacturing/production, and transportation of the materials listed have not been accounted for in this EPD.]		appropriate transparency of data gaps.
89	Batson	Annex 1-5	Table 1	Sub	*Revise this statement:* *~~Antistrip Agents~~* *Liquid Antistrip Agents* *Amidoamines* *~~Hydrated Lime~~* *Imidazolines* *Organo-metallics* *Polyamines*	The table should match the definition of liquid antistrip and then hydrated lime.	The proposed revision was accepted with changes. Table 1 has been reorganized and revised to better reflect general classifications of additives. Liquid antistrips has been added as a subcategory under antistrip agents.
90	Batson	Annex 1-5	Table 1	Sub	*Add Warm Mix Additive Category Data Gap* *Chemical (such as lubricating surfactants)* *Organic (such as Fischer-Tropsch waxes)*	There was no category for Warm Mix Additive.	The proposed revision was accepted with changes. See response to Comment 89.
91	Batson	Annex 1-5	Table 1	Sub	*Add Hydrated Lime*	The table should match the definition section and hydrated lime should have its own "type."	See response to comment 89.
92	Carlisle	18	5.1.1	Ed	Appreciate the clarity of the		Thank you for the comment.

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					language surrounding the appropriate use of EPDs to support comparison and development of LCAs of pavements.		
93	Carlisle	21	5.3	Ed	Comparability language is a big improvement over the last version of the PCR. Appreciate the guidance it provides in terms of facilitating appropriate comparisons by product function.	Comparability is an important driver in the production of product-specific and mix-specific EPDs. Product comparisons is going to happen and it is incredibly useful for the PCR to be as specific as it can in terms of guiding useful comparisons.	Thank you for the comment. Note that the comparability statement was revised. See response to Comment 61.
94	Carlisle	41	7.2.7	Ed	I appreciate the conservative approach to Biogenic carbon in this EPD and the move to prohibit use of negative accounting, but to count combustion of biofuels.		Thank you for the comment. Note that negative accounting of biogenic carbon flows will be allowed when provided in upstream datasets. See response to Comments 5 and 7.