
Pavement Preservation Products Product Category Rule

Number 72141127-2017

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A Program of
Institute for Environmental Research and Education
PO Box 2449, Vashon WA 98070
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General Information

This document is a revision of a Product Category Rule (PCR) for pavement preservation products, to support the production of Environmental Product Declarations in accordance with ISO 14025. This is version two of this PCR.

This PCR is developed in conformity with ISO 14040, 14044, 14025 and IERE's Earthsure Program General Program Instructions.

The PCR Development was funded by Asphalt Systems, Inc. (ASI)

Program Operator

The program operator is

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PCR Committee:

Members of the PCR Committee were:

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Angela Folkestad	Concrete Paving Association
Joe LaRusso	Asphalt Systems, Inc.
Richard Willis	National Asphalt Pavement Association

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Standards Conformity

These standards are incorporated by reference

- Concrete Pavement Preservation Guide, Second Edition (National Concrete Pavement Technology Center, 2014)
- Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal Surfaces, International Slurry Surfacing Association A105 (International Slurry Surfacing Association, 2010)

- ASTM D6433 - Current Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys (ASTM, 2016)
- ASTM 5340- 12 Standard Test Method for Airport Pavement Condition Index Surveys (ASTM, 2012)
- ISO 14020-2000: Environmental labels and declarations – General principles (ISO, 2000)
- ISO 14044-2006. Environmental management — Life cycle assessment — Requirements and guidelines (ISO, 2006)
- ISO 14025-2006: Environmental labels and declarations —Type III environmental declarations — Principles and procedures (ISO, 2006)

Scope of PCR

This PCR refers to the production, distribution, application and use of particular treatment systems to preserve pavements. It includes all products that are applied to paved surfaces, such as airport runways, roads, parking lots, driveways and the like. It does not include hot and cold mix asphalt; which is covered by the NAPA PCR (NAPA, 2017) it does not include the service of applying the materials as a separate product category (although the application is included in the analysis). It does not include striping, lighting, and other ancillary road maintenance products.

Product Code

UNSPSC: 72141127 Seal coating of roads, highways and parking lots. No UN CPC codes correspond to this product category.

Geography:

This PCR is appropriate for use in North America

Language:

This PCR was prepared in English

Comments:

Comments may be addressed to staff@iere.org, who will initiate editorial changes as needed: substantive changes will be addressed with the PCR committee as a whole.

PCR Review and Background Information

PCR Reviewer

This PCR is the second version for this product group. Per the Earthsure General Program Instructions, the review was performed by one reviewer, Tom Gloria, Ph.D. (Harvard University)

Open Consultation

The PCR as a draft was posted on the IERE website for one month prior to finalization, and notice sent via IERE's extensive email list. All comments were addressed (comments and responses available on the IERE website). Comments were received from The National Highway Administration.

Existing PCRs

To the best of our knowledge, the Earthsure PCR is the only existing PCR for this product category worldwide.

Reason for Development:

The existing PCR has expired.

Underlying Studies

Since this PCR was first developed, the US pavement industry has become much more active in the field of LCA and Environmental Product Declarations (EPDs). Thus, for example, the National Asphalt Paving Association (NAPA) has become a program operator of the industry, and has developed a PCR and an automated EPD system for asphalt (NAPA, 2017). The Federal Highway Administration has developed guidance for road LCA studies (Federal Highway Administration, 2016). The concrete industry, using the Carbon Leadership Forum as its program operator, developed PCRs for cement and for concrete (Carbon Leadership Forum, 2013). Extensive literature of LCAs for roads and pavements exists, as noted in Federal Highway Administration, (2016). These studies all point the way to the wide array of scoping decisions that have been made in this field, resulting in very different results as system boundaries were set differently. This PCR, by limiting scoping variation can help provide clarity related to the important part of a road life cycle, the use and maintenance phase.

Goal and Scope

System Function:

Pavement preservation products restore the function of the existing pavement system and extend its service life, not increasing its capacity or strength.

Functional Unit:

The functional unit is one square meter year of pavement preserved in average condition per ASTM D6433 or ASTM D5340. The reference flow should be the lifetime of the pavement preservation product (the intervals between reapplication).

Scope

The scope of the PCR is Cradle to Grave.

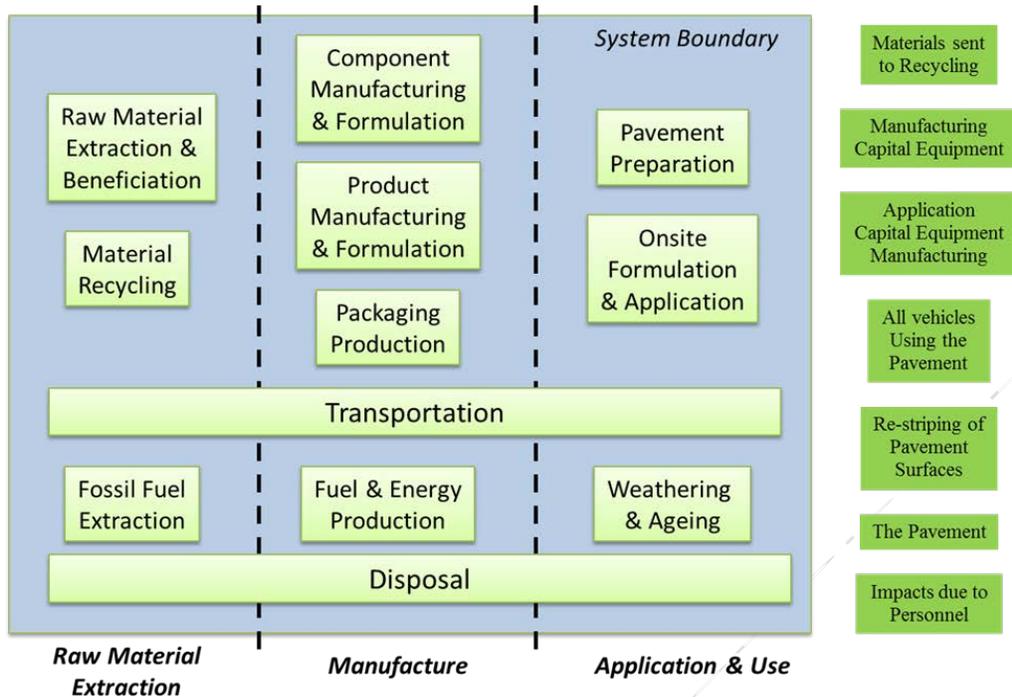
The purpose of the PCR is to provide a detailed method for developing a business-to-business environmental product declaration to support comparable, informed, and objective sustainable purchasing.

System Boundaries

The System includes all resource extraction, transport, manufacture, distribution, and application of pavement preservation products. Excluded from consideration are the impacts of the cars using the pavement, ancillary pavement items such as lighting, signage, and painting; personnel impacts (e.g. food and waste water) and the impacts of manufacture of capital items, for example manufacturing buildings and machinery, the manufacture of transport and application vehicles. Because the LCI model is based on recycled content (the strict sustainability model or the cutoff approach), all materials sent to recycling are excluded from the system boundary, while all waste management and treatment and the production of secondary materials are included in the model.

Data Quality Requirements

System Flow Chart



Data Quality Requirements

The data shall be evaluated for quality using the pedigree matrix (Weidema, 1996). Each unit process shall be listed in a table with all the quality parameters and the pedigree matrix score for it.

Primary Data

Primary data shall be based on the actual process and collected for one year of operation. If the material is produced seasonally for a full season of production, dates over which the data was collected shall be disclosed. Primary data shall be no more than two years old. Primary transportation data shall be based on actual mode and distance to the facility and the annual average of the mode and distance to the customer. If this data is not available, the most distant customer or supplier shall be used to model product distribution.

Secondary Data

Secondary data shall be most closely related to the actual situation. Where data is lacking on any unit process a proxy may be used, up to 10% of mass or energy in aggregate. All proxy data shall undergo a sensitivity analysis at twice and half the amount of the proxy in the model.

LCI Modelling

Transport

The transportation model will ideally be based on actual information on fuel consumption and mode of transport. Where the transport is via common carrier, the following assumptions will be made:

- All rail is assumed to have no empty haul-back. It is diesel powered.

- Road transport is via diesel powered 20-ton tractor-trailers, with empty haul-back 50% of the time.
- Ocean transport has no empty haul-back. It is diesel powered using bunker oil.

Allocation

With the exception of energy producing processes, where unit operations have more than one product, the impact of the operations, including waste disposal is allocated according to the mass of the product. Where the mass of the product is not known, another unit may be used, but it shall be converted to mass, and a sensitivity analysis performed on the potential range of the conversion. In the case of energy producing operations, the impacts are allocated according to energy production, on a useful energy equivalent basis.

Recycling

Any wastes that are recycled (including those used for energy recovery) leave the system boundary. When recycled materials are included in the product, the impact of recycling is calculated from the point of discard, either at the discarding facility or at the waste management center.

Where waste disposal methods are known, they shall be modeled for waste disposal. Where they are not known, the most recent waste inventory data from the U.S. EPA Office of Solid Waste or equivalent for the host country shall be used.

No credit for bio-based greenhouse gases may be employed. However, sequestration of carbon into bio-based materials may be accounted for during raw material unit processes, which shall include all the emissions created during growing, harvesting and transporting the biomass.

No carbon offset credits may be included in the calculation.

Cut-off Rule

At least 95% of all mass and energy used in the system shall be accounted for. No single flow that represents more than 1% of the total mass or energy flow may be excluded. All known toxic materials shall be accounted for. At a minimum, all U.S. EPA Toxics Release Inventory Chemicals shall be evaluated.

Unit Processes

At a minimum, the following ecosphere flows shall be evaluated in the inventory for new (primary) unit processes, divided into releases to or removals from air, water and soil. If there is no flow, zeros should be noted. All Ecosphere inputs shall be in units of in-nature amounts, e.g. nickel (in ground).

- All greenhouse gases identified in the most recent IPCC technical report;
- All fixed nitrogen; all phosphorus;
- Categorical groups such as PM, TSS, VOCs, BOD and COD;
- All substances on the US EPA Toxics Release Inventory;
- All water withdrawal and release,
- All removals of atmospheric components (O₂, N₂. etc.);

- All fossil fuels extracted;
- Land occupation (in units of area-years) and land use change

The entire inventory shall be made available to the reviewer.

All foreground technosphere data shall be primary data, collected over the most recent calendar year of operation (the calendar year need not be January to December). The calendar year shall be disclosed in the EPD.

Companies seeking the EPD shall seek primary data from their first tier suppliers representing at least 80% of the mass of their technosphere inflows. Only when data is not available may they use secondary or tertiary data sources.

The electric grid for foreground operations should represent the local electric grid (as supplied by the local electric utility). Where unit operations are background data, or where the local utility will not provide the data, they should represent the most appropriate regional or national electric grid data as published by the U.S. LCI Database, the EU Database (ELCD) or other relevant national database. Where the unit process is powered by wind or solar power and no electricity leaves the facility (i.e. the system is not grid-linked), renewable electricity produced from wind or solar may be accounted for in the system.

All inventory data shall be in SI (metric) units. Results shall be reported with only two significant figures. (US EPA, 2017)

Temporal Issues

The life cycle inventory shall include information about the age of the data. All foreground data shall be no more than two years old. No data more than 10 years old may be used, unless it is affirmed by a competent authority that the processes they describe have not substantively changed.

<i>Asphalt Pavements</i>	<i>Minimum Pavement Life Extension (years)</i>
Fog Seals	1
Crack Filling	1
Crack Sealing	2
Slurry Seals	3
Micro Surfacing	5
Chip Seals	4
Ultra-Thin Bonded Wearing Course	5
<i>Concrete Pavements</i>	<i>Pavement Life Extension (years)</i>
Crack Sealing	1
Joint Resealing	5

If default values are not used, the EPD owner shall provide documentation of the expected pavement extension value, either through statistical analysis of existing use, or through engineering calculations.

Calculations shall be based on the range of anticipated application environments and conditions, and the calculated value for pavement extension shall represent an arithmetic mean of the measured or calculated scenarios. Calculated scenarios should consider climate, weather during application and initial pavement condition.

During the use phase, there are losses due to volatilization, UV degradation, and physical debridement. These shall be estimated based on the average scenario described above. Where the losses in runoff or in volatilization are not measured, the total bulk amount of the volatiles and semivolatiles in the virgin material shall be assumed to be released. Semivolatiles shall be characterized using US EPA method 8270 of SW846x or equivalent. Non-volatile components shall be assumed to be landfilled as part of the next life cycle of pavement preservation product, unless it can be shown that the material is recycled into the next use of the product (e.g. through in-place asphalt recycling).

A flow chart showing the system boundaries shall be included in the LCA study.

The unit process based Life cycle inventory shall describe each of the unit processes as described above and as called out in ISO 14040 and 14044. Data from available databases may be described by the information in those databases.

When primary data is developed, the ecosphere flows should be accompanied by the relevant CAS codes while the technosphere flows should be accompanied by the relevant UNSPSC number

Example Metadata

Extraction of sand. Includes the removal of sand using heavy equipment and the sorting of the sand by size using a mechanical sieving machine.		
Ecosphere inputs:	Sand in-ground CAS # 99439-28-8	Primary data
Land occupation		Primary data
Technosphere inputs	Diesel fuel UNSPSC 15101505	Primary data
Lubricating oil	UNSPSC 15121520	Primary data
Electricity, single phase	UNSPSC 83101801	Primary data
Ecosphere outputs:	(all calculated based on AP42)	Secondary data

The inventory shall disclose the percent of technosphere flow inventory that that are primary data. All emissions factors used shall be identified as primary (developed for the local unit process,

or based on biological, chemical or physical constants such as stoichiometric equivalents), secondary (derived from studies of equivalent processes) or tertiary (derived from the aggregation of multiple similar process).

The length of time of pavement life extension may be calculated using the default values shown below. These default figures represent the minimum life extension or service life of the product.

Use Phase Models

During the use phase, there are losses of product due to volatilization, UV degradation, and physical debridement. These shall be estimated based on the average scenario described above. Where the losses in runoff or in volatilization are not measured, the total bulk amount of the volatiles and semivolatiles in the virgin material shall be assumed to be released. Semivolatiles shall be characterized using US EPA method 8270 of SW846 (US EPA, 2017) or equivalent. Non-volatile components shall be assumed to be landfilled as part of the next life cycle of pavement preservation product, unless it can be shown that the material is recycled into the next use of the product (e.g. through in-place asphalt recycling).

Life Cycle Impact Assessment

The impact assessment for methodology is based on expected impacts from the production, application and use of pavement preservation products.

They will be evaluated using the US EPA TRACI 2.1 methodology (Bare, 2011)

The impact categories are:

- Ozone depletion,
- Climate change,
- Acidification,
- Eutrophication,
- Smog formation,
- Human health impacts
- Ecotoxicity

Inventory figures

- Primary Energy use (total/renewable)
- Materials use (total/renewable)
- Fossil Fuel use (feedstock and total)

In addition, the consumptive use of water shall be provided in units of Liters per functional unit.

Other measures to be disclosed

All toxic materials in quantities greater than 0.1% by mass in the product as required by the UN Globally Harmonized System for Safety Data Sheets shall be disclosed on the EPD. Documentation for this disclosure shall include the SDSs of components of the product.

The business or business unit manager shall sign a declaration that affirms that the information disclosed in the EPD is true and correct to the best of his/her knowledge.

LCA Data

Results

A Life Cycle Report in conformity with ISO 14044, the Earthsure GPI and this PCR shall be prepared and reviewed by the validator, who shall be an LCACP or the equivalent.

The results shall be shown as aggregated by life cycle stage, in terms of impact indicator results per functional unit (or volume, in the case water use). No more than two significant digits shall be shown.

Interpretation

Sensitivity analyses must be performed on the following assumptions:

- The composition of the product, taking into account the reasonable range of its composition at application;
- Any allocation that could not be performed directly using mass or energy data;
- Unless default minimum values are used, the range of road lifetime extension of the product.;
- The use of proxy data.

Uncertainty

Wherever possible, primary data should be calculated providing the mean, standard deviation and statistical distribution of the data. This data will support analysis of reproducibility and uncertainty of the data. Where these analyses are not possible, it will be assumed that the data are log-normally distributed with a relative standard deviation of 100%.

The uncertainty due to data quality shall be analyzed and reported using the pedigree matrix. (Weidema, 1996).

EPD Format and Report

An example of the format is shown in Appendix A, and the EPDs should be substantively similar to the example.

The format of the EPD shall be as follows

- The name of the product, with any numerical identifier
- A description of the use of the product (e.g. as fog seal on asphalt, as sealer on cement)
- Any specifications or consensus standards the product meets
- A photograph of the product either in the container (for packaged shipment) or during application or use (for bulk shipments).
- The name of the producer of the product
- The name of the PCR and the Program Operator
- The date of expiry of the EPD
- The table of the impact indicator results, shown by life cycle stage
- List of SDS toxic materials, with percent content
- Signature by business unit manager that the EPD is true and correct to the best of his/her knowledge
- Validation by third party LCACP that the EPD conforms with this PCR.

- Contact information for the validator.
- **Definitions**
 - AP 42: Air Pollution 42: a program of the U.S EPA for estimating air pollution emissions from industrial processes
 - CAS Number numerical identifier of chemicals provided by the Chemical Abstracts Service.
 - Competent Authority: an individual with a higher degree or at least five years experience in the relevant industry.
 - Consumptive Water Use: water removed from available supplies without return to a water resources system, e.g. water used in manufacturing, agriculture, and food preparation.
 - Ecosphere flows: raw materials taken from nature or returned to nature.
 - Foreground Data: data in processes under the direct control of the EPD owner.
 - Primary Data: raw data collected by the individuals in question, e.g., electricity invoices, stack test results, monthly monitoring data, etc.
 - Secondary Data: aggregated or modified data from a reputable source, e.g. descriptions of the local electric grid derived from the local utility, published peer reviewed articles, etc.
 - Semivolatiles: organic compounds typically having boiling points above 150 degrees Centigrade, and vapor pressures below 0.01 mm mercury.
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- **Acronyms**
 - ASTM: American Society for Testing and Materials
 - BOD: Biological Oxygen Demand
 - COD: Chemical Oxygen Demand
 - EPA: Environmental Protection Agency
 - EPD: Environmental Product Declaration
 - ISO: international Association for Standardization
 - LCACP: Life Cycle Assessment Certified Professional.
 - LCA: Life Cycle Assessment
 - LCI: Life Cycle Inventory
 - LCIA: Life Cycle Impact Assessment
 - PM: Particulate matter (air)
 - PCR: Product Category Rule
 - TSS: Total suspended solids (water)
 - VOCs: Volatile Organic Substances

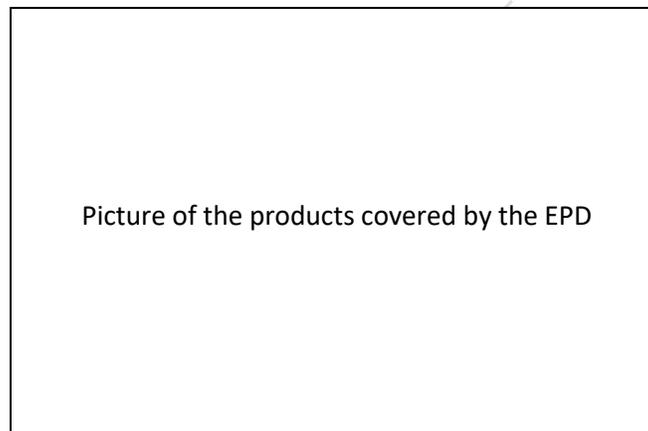
Appendix A: Mockup of EPD

Environmental Product Declaration For XYZ Product, ABC Pavement Preservers

Product Information

XYZ product covers all kinds of asphalt pavements and extends their life four years on average. It is applied by spraying onto surfaces either by hand spray for small areas or by truck spray applicator for larger applications.

The analysis shown here was performed in accordance with the Earthsure Environmental Product Declaration Program, using the product category rule for pavement preservation products. The analysis is based on a life cycle assessment of XYZ Product, using data collected from January to December, 2012. Environmental Product Declarations from other sources using different Product Category Rules may not be comparable to this one.

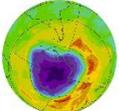


Measurement Certification

Product Name	XYZ Product
Product ID number(s)	12345, 12345b, 12346
Meets quality specification	California technical specification ABC123, ISSI Standards 143 and ARRA standard 987.
Product Category Rule	Earthsure Pavement Preservation Products
Product Category Rule Operator	Earthsure program, IERE PO Box 2449, Vashon WA 98070 earthsure.org 206-463-7430
This EPD is valid until	February 2016
Validator Name	John Smith
Validator Signature	
LCACP Registration Number	LCACP 2008-22
Date	25 January 2013



The Life Cycle Environmental Impact of preserving one square meter of pavement for one year using XYZ Product

		Raw Materials	Transport	Manu- facturing	Application and Use	Equivalent Units
	Stratospheric Ozone depletion 0.01	0.001	0.008	0	0.001	Grams CFC-11
	Climate Change 740	400	50	40	150	Grams CO ₂
	Acidification 1.7	1	.01	.05	.6	Grams H ⁺
	Eutrophication 0.34	.01	.01	.02	.3	Grams SO ₂
	Human Toxicity 0.0018	.0005	.0008	.00001	.0005	TU
	Ecotoxicity 5.7	5	1	.5	1	TU
	Photochemical Smog 0.22	.005	.01	.001	.2	Grams NO ₂
	Primary Energy Use Total/Renewable 280/51	150/14	30/29	20/18	75/0	mJ
	Material Resource Use Total/Renewable 7/0	2/0	0/0	0/0	5/0	Grams minerals
	Water Resource 7.5	5	.01	.5	2	Liters water
	Fossil Fuel Use Total/feedstock 230/100	140/100	30/0	2/0	75/0	MJ

More information on XYZ Product

XYZ Product contains these hazardous materials	
CAS Number	Name
1310-73-2	Sodium Hydroxide
8002-05-9	Petroleum distillates
8012-56-4	Sodium dodecyl sulfate
To the best of our knowledge, XYZ Product contains no endocrine disrupters as defined by the European Commission.	
Percentage of primary technosphere data	62%
Dates of data collection	January-December 2012

Product Owner Certification

I have personally examined the conditions and the individuals performing this analysis and to the best of my knowledge, these representations are true and accurate.	
Name	Jane Doe, CEO
Date	30 January, 2013
Signature	

Disclaimers

The analyses presented here were performed with all due care, but the user should realize that they represent the average results measured under standardized conditions and the actual environmental performance will vary depending on the particular application, the climate, the traffic type and intensity and other factors beyond the control of ABC Pavement Preservers.

The results shown here pertain only to the referenced product category rule. They should not be compared directly to results using a different product category rule.

For more information, contact:

ABC Pavement Preservers
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712-222-2222

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