September 22, 2021

Environmental Product Declaration

Ingevity

Warm Mix Asphalt Additive, Warm Mix Asphalt Chemical Additive, Warm Mix Asphalt Chemical Package

Evotherm M1

Self-declared core EPD based on the EN15804:2012 + A2

Issue date	9/22/2021
Valid untill	9/21/2026
Collection period	2020

Company
Ingevity Corporation
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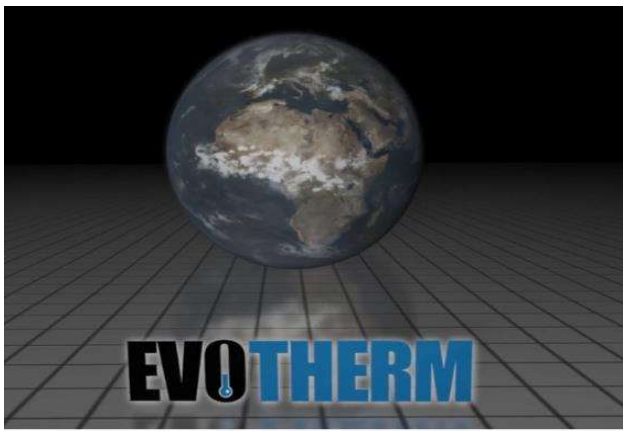
Demonstration of verification

EN15804:2012+A2 serves as core PCR	
Third party verification of the declaration, according to ISO	
o Internal	**x** External
Third party verifier	The Right Environment Ltd.

Data on this certificate have been generated by The Right Environment Ltd. using SimaPro

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data records to be compared have been drawn up in accordance with EN 15804 and the building context and/or product-specific performance features are taken into consideration. EPDs of construction products may not be comparable if the requirements in EN 15804 section 5.3 are not met, the EPDs are not seen in a building context, and other requirements (e.g. background LCI data, assumptions around onsite emission measurements, type of EPD, reference service life, boundary conditions and functionality) are not equivalent.

Product



Declared Unit
1 metric ton (1000 kg)

Representative Market
Ingevity Evotherm M1 product produced in N. Charleston, SC (U.S.A.) for markets in all nations globally.

Declaration of Material Content

Density	1.0	kg/l
Water	0	%wt.

Product Description and Intended Use
The main application of this products is low temperature manufacture and placement of asphalt paving mixtures.

The comparison of products on the basis of their EPD is defined by the contribution they have to the environmental performance on asphalt mixture manufacture and asphalt pavement construction. Consequently comparison of the environmental performance of construction products using the EPD information shall be based on the product's use in and its impacts on the construction materials and works, and shall consider the complete life cycle (all information modules), meaning cradle-to-grave. In addition to the environmental impacts covered in a cradle-to-grave LCA, the durability of a product's performance in the application needs to be evaluated.

Reference
All information related to the content and safety of our products can be obtained by contacting Ingevity Pavement Technologies technical support.

Safety Data Sheet
Evotherm M1 is manufactured using common, industrial-scale specialty chemical manufacturing processes compliant with ISO 9001:2015 quality management requirements. Ingevity Evotherm M1 is neither a PBT (persistent, bioaccumulative, and toxic) substance nor does it contain substances of very high concern, which are as listed by the European Chemicals Agency. Ingevity Evotherm M1 is safe to use and carries the sensitizer and aquatic hazard labels. If more information is required, please contact Ingevity.B60

Substances Considered under European Chemicals Regulation REACH
All information related to the content and safety of our products can be obtained by contacting our technical support. Ingevity Evotherm M1 does not contain substances of very high concern.

Life-Cycle Assessment: Calculation Rules

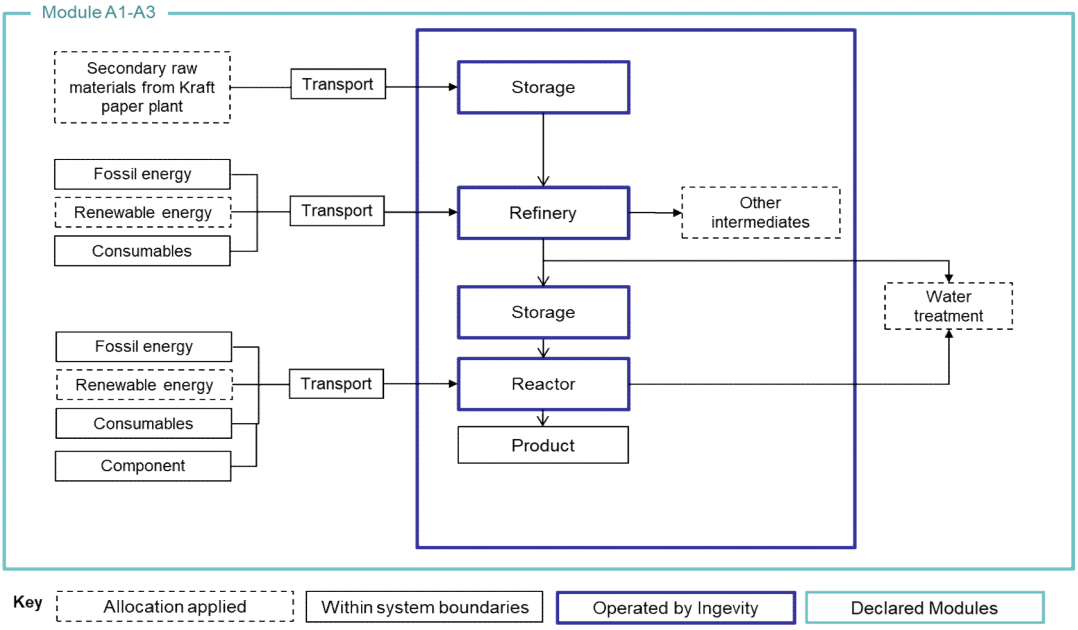
System Boundaries and Flow Diagram

The process tree for the declared product (material and energy inputs smaller than 1% are excluded from flow chart)

Other Rules

The biogenic carbon content and both renewable and fossil feedstock energy content of Evotherm M1 are declared. Economic allocation has been used for the use of a by-product of the kraft paper industry. Mass allocation has been used for the processing at Ingevity. Suppliers have been contacted but literature data has been used for one of the components of M1. Packaging has been excluded.

EPD type
Cradle-to-gate Ingevity admixtures are used in an asphalt mix design. Only module A1, A2 and A3 are declared.



Life-Cycle Assessment

Limitations

Results can be considered to be conservative and worst case. Carbon offsetting is not allowed in the EN 15804 and hence are not considered in the calculations. No benefits and load beyond the system boundaries have been declared.

Life cycle stages

(MND = Module not assessed/declared)

Product stage	Delivery	Installation	Use and maintenance	End-of-life				Module D
A1, A2, A3	A4	A5	B1 – B7	C1	C2	C3	C4	D
X	MND	MND	MND	MND	MND	MND	MND	MND

Environmental Profile (EN15804:2021+A2)

			Product stage	Delivery	Installation	Use and maintenance	End-of-life				Module D
	Parameter	Unit	A1, A2, A3	A4	A5	B1 – B7	C1	C2	C3	C4	D
	Climate change	kg CO2 eq	4.75E+03	MND	MND	MND	MND	MND	MND	MND	MND
	Ozone depletion	kg CFC11 eq	2.51E-03	MND	MND	MND	MND	MND	MND	MND	MND
[1]	Ionising radiation	kBq U-235 eq	4.20E+01	MND	MND	MND	MND	MND	MND	MND	MND
	Photochemical ozone formation	kg NMVOC eq	1.39E+03	MND	MND	MND	MND	MND	MND	MND	MND
	Particulate matter	disease inc.	2.67E-04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, non-cancer	CTUh	9.78E-04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, cancer	CTUh	5.82E-04	MND	MND	MND	MND	MND	MND	MND	MND
	Acidification	mol H+ eq	4.96E+01	MND	MND	MND	MND	MND	MND	MND	MND
	Eutrophication, freshwater	kg P eq	1.60E-01	MND	MND	MND	MND	MND	MND	MND	MND
	Eutrophication, marine	kg N eq	1.56E+01	MND	MND	MND	MND	MND	MND	MND	MND
	Eutrophication, terrestrial	mol N eq	9.81E+01	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Ecotoxicity, freshwater	CTUe	3.25E+05	MND	MND	MND	MND	MND	MND	MND	MND
	Land use	Pt	1.81E+04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Water use	m3 depriv.	1.44E+04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Resource use, fossils	MJ	9.56E+04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Resource use, minerals and metals	kg Sb eq	1.62E-02	MND	MND	MND	MND	MND	MND	MND	MND
	Climate change - Fossil	kg CO2 eq	6.29E+03	MND	MND	MND	MND	MND	MND	MND	MND
	Climate change - Biogenic	kg CO2 eq	-1.54E+03	MND	MND	MND	MND	MND	MND	MND	MND
	Climate change - Land use and LU change	kg CO2 eq	9.51E-02	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, non-cancer - organics	CTUh	6.34E-04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, non-cancer - inorganics	CTUh	4.99E-05	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, non-cancer - metals	CTUh	2.95E-04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, cancer - organics	CTUh	5.79E-04	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, cancer - inorganics	CTUh	0.00E+00	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Human toxicity, cancer - metals	CTUh	3.15E-06	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Ecotoxicity, freshwater - organics	CTUe	4.06E+03	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Ecotoxicity, freshwater - inorganics	CTUe	2.58E+05	MND	MND	MND	MND	MND	MND	MND	MND
[2]	Ecotoxicity, freshwater - metals	CTUe	6.23E+04	MND	MND	MND	MND	MND	MND	MND	MND

[1] This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

[2] The results shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Resource Input (use of) (EN15804:2021+A2)

		Product stage	Delivery	Installation	Use and maintenance	End-of-life				Module D
Parameter	Unit	A1, A2, A3	A4	A5	B1 – B7	C1	C2	C3	C4	D
Renewable primary energy, excluding renewable resources used as raw materials	MJ, ncv	1.97E+03	MND	MND	MND	MND	MND	MND	MND	MND
Renewable primary energy resources used as raw materials	MJ, ncv	1.71E+04	MND	MND	MND	MND	MND	MND	MND	MND
Total renewable primary resources	MJ, ncv	1.90E+04	MND	MND	MND	MND	MND	MND	MND	MND
Non renewable primary energy, excluding resources used as materials	MJ, ncv	1.04E+05	MND	MND	MND	MND	MND	MND	MND	MND
Non renewable primary energy used as raw materials	MJ, ncv	1.93E+04	MND	MND	MND	MND	MND	MND	MND	MND
Total non renewable primary energy resources	MJ, ncv	1.23E+05	MND	MND	MND	MND	MND	MND	MND	MND
Secondary material	kg	0.00E+00	MND	MND	MND	MND	MND	MND	MND	MND
Renewable secondary fuels	MJ	1.23E+03	MND	MND	MND	MND	MND	MND	MND	MND
Non renewable secondary fuels	MJ	0.00E+00	MND	MND	MND	MND	MND	MND	MND	MND
Input of fresh water	m3	4.14E+02	MND	MND	MND	MND	MND	MND	MND	MND

ncv net calorific value

Waste Categories (Disposed) (EN15804:2021+A2)

		Product stage	Delivery	Installation	Use and maintenance	End-of-life				Module D
Parameter	Unit	A1, A2, A3	A4	A5	B1 – B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	2.96E-01	MND	MND	MND	MND	MND	MND	MND	MND
Non hazardous waste disposed	kg	3.63E+02	MND	MND	MND	MND	MND	MND	MND	MND
Radioactive waste disposed	kg	2.96E-01	MND	MND	MND	MND	MND	MND	MND	MND

Further Output Material Flows (EN15804:2021+A2)

		After use
Parameter	Unit	
Components for reuse	kg	0.00E+00
Materials for recycling	kg	1.00E+03
Materials for energy recovery	kg	0.00E+00
Exported electric energy	MJ	0.00E+00
Exported thermal energy	MJ	0.00E+00

Environmental Profile (TRACI 2.1)

		Product stage	Delivery	Installation	Use and maintenance	End-of-life				Module D
Parameter	Unit	A1, A2, A3	A4	A5	B1 – B7	C1	C2	C3	C4	D
Ozone Depletion	kg CFK-11	1.24E-02	MND	MND	MND	MND	MND	MND	MND	MND
Global Warming	kg CO2	5.99E+03	MND	MND	MND	MND	MND	MND	MND	MND
Smog	kg O3	8.22E+03	MND	MND	MND	MND	MND	MND	MND	MND
Acidification	kg SO2	4.29E+01	MND	MND	MND	MND	MND	MND	MND	MND
Eutrophication	kg N eq	9.35E+00	MND	MND	MND	MND	MND	MND	MND	MND
Carcinogenics	CTUh	5.91E-04	MND	MND	MND	MND	MND	MND	MND	MND
Non-carcinogenics	CTUh	2.12E-03	MND	MND	MND	MND	MND	MND	MND	MND
Respiratory effects	kg PM2.5 eq	3.31E+00	MND	MND	MND	MND	MND	MND	MND	MND
Ecotoxicity	CTUh	9.40E+03	MND	MND	MND	MND	MND	MND	MND	MND
Fossil fuel depletion	MJ surplus	1.15E+04	MND	MND	MND	MND	MND	MND	MND	MND

Biogenic Carbon (in Product) (Included in EN15804 Results, not Included in the TRACI Results)

Biogenic carbon	0.323	ton/ton

Other information

Emissions

There are no indoor air health quality related concerns for the use of the products declared as the application is outdoors. There are no emissions to soil and water during the use stage.

Normative References

• ASTM D803-15 (2020) “Standard Test Methods for Testing Tall Oil
• ASTM D6816-11 (2016) Standard Practice for Determining Low-Temperature Performance Grade (PG) of Asphalt Binders (equivalent to AASHTO R49)
• ASTM D7643-16 Standard Practice for Determining the Continuous Grading Temperatures and Continuous Grades for PG Graded Asphalt • Binders (equivalent to AASHTO M320)
• ASTM D6373-21 Standard Specification for Performance-Graded Asphalt Binder (equivalent to AASHTO M332)
• ASTM D2726/D2726M-19 Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures (equivalent to AASHTO T166)

Standards that apply to methodology and rules for this EPD:
• ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
• ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.
• ISO 14025:2006: Environmental labels and Declarations-Type III Environmental Declarations-Principles and procedures.
• EN 15804+A2:2019