

Environmental Product Declaration (EPD)

1.1. General information

1.1.1 Product

Anova® 1501 Warm Mix Additive

1.1.2 Product code

Anova® 1501 Warm Mix Additive

1.1.3 Product unit

1 kg

1.1.4 Description of the product

Cargill has developed a warm mixture additive (WMA) Anova® for the asphalt industry. This product, named Anova® 1501, is a non-toxic, biobased, non-corrosive and liquid additive that at low dosage levels enhances asphalt mixture workability, improves adhesion, and allows for production and compaction at lower temperatures. When used at recommended dosages, Anova® 1501 does not substantially change the rheological grade of the asphalt binder (Performance Grade, Penetration, Softening Point, etc.).



Data Completeness Statement: Upstream data for all ingredients representing more than 1% (individually) or 5% (total) of the total mass of this product are available.

1.1.5 LCA standards

This declaration is an EPD in accordance with ISO 14025:2006 [1] and ISO 21930:2017 [2]. For this LCA report no specific PCR (Product Category Rules) is used. This EPD is a self-declared EPD, meaning it is not constructed by an EPD program operator. This EPD transparently describes the potential environmental impacts associated with the identified life cycle stages of the described product.

This EPD is valid for Anova® WMA 1501 produced at the Cargill facility in Chicago, IL, US. Data used to inform this EPD reflect plant operations from a 12-month period beginning on Jan. 1, 2021.

LCA standard: ISO 14040:2006 [3]
 Standard (LCA) database: Ecoinvent 3.6
 Core PCR: ISO 21930:2017
 Sub-Category PCR: Not relevant

1.1.6 Statement of EPD comparability

EPDs within the same product category but from different programs may not be comparable. EPDs are comparable only if they comply with ISO 21930:2017, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works. EPD data may not be comparable if the datasets used are not developed in accordance with ISO21930:2017 and if the background systems are not based on the same database.

1.1.7 LCA Modules

The following modules are taken into account in the EPD: A1-A3
 The following modules are not declared (MND) in this EPD: A4, A5, B1-B7, C1-4 & D.

| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|--|----|----|-----|-----|---|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|
| ☑ | ☑ | ☑ | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |
| Product stage | | | | | Use stage | | | | | | | End-of-Life stage | | | | |
| A1 Raw material supply A2 Transport A3 Manufacturing | | | | | B1 Use B2 Maintenance B3 Repair B4 Replacement B5 Refurbishment B6 Operational energy use B7 Operational water use | | | | | | | C1 De-construction demolition C2 Transport C3 Waste processing C4 Disposal | | | | |
| Construction process stage | | | | | Benefits and loads beyond the system boundaries | | | | | | | | | | | |
| A4 Transport gate to site A5 Assembly / Construction installation process | | | | | D Reuse- Recovery- Recycling- potential | | | | | | | | | | | |

1.1.8 Verification statement

Externally verified: Yes
 Issue date: 25-01-2023
 End of validity: 25-01-2028



Validity: This EPD has been verified in accordance with ISO 14025 and is valid for 5 years from the date of issue.

Independent third-party verification: Statement by verifier, MSc P.F. Stadhouders 25-1-2023:

“The methodology and data collection as described in this report are executed in accordance with ISO 14040, ISO 14044, ISO 14025 and the ISO21930:2017.”



1.1.9 Company information

Owner of the EPD: Cargill Inc.

Name and location of production sites: Cargill, Chicago (US)

12201 S Torrence Ave, Chicago IL 60617

United States of America

1.1.10 EPD Details

Author of the LCA: Ieke Bak from Ecochain Technologies B.V.

EPD created with LCA software: Ecochain Mobius

Developed by: Ecochain Technologies B.V.

Address Ecochain: H.J.E. Wenckebachweg 123 | 1096 AM Amsterdam

The LCA background information and the project file are registered in the online application Ecochain Mobius version 0.9.

1.2. Product information

1.2.1 Declared product

Anova® 1501 Warm Mix Additive

1.2.2 General description of the product and production process

Anova® 1501 Additive is a non-toxic, biobased, non-corrosive and liquid additive that at low dosage levels enhances asphalt mixture workability, improves adhesion, and allows for production and compaction of asphalt mixtures at lower temperatures. Anova® 1501 Warm Mix Additive is typically incorporated into the asphalt bitumen at the terminal, or injected in-line into the bitumen at the hot mix asphalt plant.

1.2.3 Product use

Typical addition rates are 0.2 to 0.7% by total weight of the binder. The addition level for different mix designs should be tested and determined based on local specifications.

Declared unit:

1 kg of Anova® 1501 Warm Mix Additive

1.2.4 Reference Service Life (RSL)

Since Anova® 1501 Warm Mix Additive is used as an intermediate product into asphalt mixtures, the reference service life is dependent on the service life of the asphalt pavement.

1.2.5 Production year under study

2021



1.2.6 Product image



1.2.7 Product components and or materials

| Component (>1%) | Weight % | Identification |
|-------------------------|----------|--------------------------|
| Modified Vegetable Oils | >80 | CAS number: Trade Secret |

1.2.8 Hazardous substances

A safety data sheet (SDS) is a document produced in alignment with the UN's Globally Harmonized System of Classification and Labeling of Chemicals (GHS) that the manufacturer, importer, or distributor of a chemical product is required to provide to downstream users. The purpose of an SDS is to ensure that all workers who handle chemicals have the hazard information they need to safely use, handle, and store them. The declared SDS indicates that Anova® WMA 1501 contains no regulated hazardous substances.

1.3. LCA Calculation rules

1.3.1 Declared unit

Anova® 1501 Warm Mix Additive

1.3.2 System boundary

Type of EPD: Cradle-to-gate (A1-A3)

The system boundaries of the EPD follow the modular construction system described by ISO 21930:2017. The LCA takes into account the following modules:

Production stage (A1-A3)

This includes the following 3 modules:

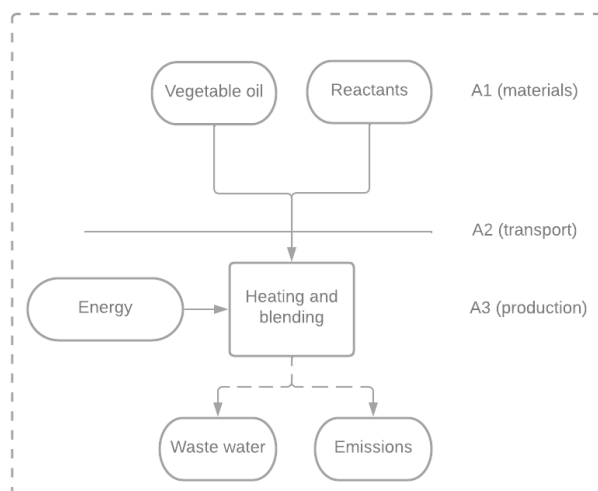
A1: Extraction and processing of raw materials. This stage includes raw material extraction and manufacturing based on the relative proportion of ingredients in the mix design.

A2: Transport to the manufacturer. This stage includes transport of raw materials to the production facility based on actual transportation distances and modes for ingredients in the mix design.

A3: Manufacturing process. This stage comprises plant operations involved in the production, including generation of electricity and heat used during production (e.g., extraction, refining, and transport of fuels). Data for this stage is plant specific.



The figure below shows the simplified process tree.



1.3.3 Data quality

For module A1, specific data for product compositions as provided by the manufacturer are used. For module A2, transportation data of the raw materials used to the production site was collected. For module A3, energy consumption and waste production data was collected for production year 2021. The used background processes are derived from Ecoinvent 3.6.

1.3.4 Allocation

Allocation was carried out in accordance with the provisions of the ISO 21930:2017. All manufacturing inputs (energy and auxiliary materials) at production site level are allocated to different production processes, followed by allocation of the production processes to the products that are produced using these processes through mass allocation. No secondary materials have been used in the production process.

1.3.5 Cut-off criteria

All relevant inputs and outputs - like emissions, energy, and materials - have been taken into account in this LCA in accordance with ISO21930:2017. No cut-offs were made. This means the total neglected input flows per module does not exceed 5% of energy usage and mass. Capital goods are included in background data as these are considered in the selected Ecoinvent references.

1.3.6 Limitations

This EPD reports the results of a cradle to gate life cycle assessment (LCA) for an asphalt additive for the asphalt industry.

1.3.7 Life Cycle Assessment

The information presented in this EPD can be used as an input to model the environmental impacts of an asphalt mix purposed to be part of (but not limited to) roadway, parking lot, or recreational pavements. This EPD alone does not provide the environmental impacts of the entire pavement structure itself and does not make any statements that the product covered by the EPD is better or worse than any other product.

1.4. LCA Scenarios and additional technical information

1.4.1 End-of-Life considerations

This is a cradle to gate EPD and does not include life cycle stages beyond the gate of the plant. Thus, in this LCA study, no scenarios are calculated or assumed regarding Modules A4, A5, B1-B7, C1-4 & D.

1.4.2 Additional technical information

- In accordance with the EN15804+A2 and the requirements of ISO 21930 this section separately reports on the biogenic carbon content of the product for the negative scores of GWP-biogenic for A1 and A3. The biogenic carbon content is shown in table 8. 1 kg of biogenic carbon is equivalent to 12/44 kg of CO₂.



Table 8: Biogenic carbon content.

| Biogenic carbon content | Unit | A1 Materials | A2 Transport | A3 Production | Total |
|--------------------------------|------|--------------|--------------|---------------|----------|
| BCCpr (product) ¹ | kg C | 4.88E-01 | 0,00E+00 | 0,00E+00 | 4.88E-01 |
| BCCpa (packaging) ² | kg C | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

- For a copy of the safety data sheets, please contact Anova-Asphalt@cargill.com
- [Anova® Warm Mix Additives | Improved compactibility at the lowest cost in use | Cargill](#)
- [Anova® WMA 1501 Product Data](#)
- [Cargill Sustainability Reporting Hub](#)

1.5. Life Cycle Impact Assessment Results

The life cycle impact assessment results are relative expressions and do not predict actual impacts on category endpoints, the exceeding of thresholds, safety margins, or risks. The LCA profile of Anova® WMA 1501 according to ISO 21930:2017 is calculated both on the TRACI v2.1 impact assessment methodology as well as the EN15804+A2 impact assessment methodology.

Table 1: TRACI 2.1 indicators per module of 1 kg of Anova® 1501 WMA

| | A1 | A2 | A3 | Total A1-A3 |
|---|----------|----------|----------|-------------|
| Core mandatory impact indicators (TRACI) | | | | |
| Global warming potential (kg CO ₂ eq.) | 7.07E-01 | 2.28E-02 | 6.74E-02 | 7.97E-01 |
| Ozone depletion (kg CFC-11 eq.) | 7.41E-08 | 5.39E-09 | 8.32E-09 | 8.78E-08 |
| Eutrophication (kg N eq.) | 1.76E-03 | 1.40E-05 | 1.96E-05 | 1.80E-03 |
| Acidification (kg SO ₂ eq.) | 2.50E-03 | 1.20E-04 | 1.10E-04 | 2.73E-03 |
| Photochemical oxidation (POCP) (kg C ₂ H ₄ eq.) | 1.96E-04 | 1.38E-05 | 1.67E-05 | 2.27E-04 |
| Additional optional impact categories (TRACI) | | | | |
| Abiotic depletion, element (ADPE) (kg Sb eq.) | 1.19E-05 | 5.84E-07 | 5.75E-08 | 1.26E-05 |
| Carcinogenics (CTUh) | 1.71E-08 | 1.94E-10 | 3.13E-10 | 1.76E-08 |
| Ecotoxicity (CTUe) | 4.53E+00 | 6.22E-02 | 2.77E-02 | 4.62E+00 |
| Fossil fuel depletion (MJ surplus) | 7.18E-01 | 4.86E-02 | 1.39E-01 | 9.06E-01 |
| Non carcinogenics (CTUh) | 1.59E-07 | 3.76E-09 | 1.70E-09 | 1.65E-07 |
| Respiratory effects (kg PM _{2.5} eq.) | 5.76E-04 | 1.59E-05 | 6.33E-05 | 6.55E-04 |
| Smog (kg O ₃ eq.) | 4.65E-02 | 3.00E-03 | 1.31E-03 | 5.09E-02 |

Table 2: EN15804+A2 indicators per module of 1 kg of Anova® 1501 WMA

| EN15804+A2 | A1 | A2 | A3 | A1-A3 |
|---|-----------|----------|----------|-----------|
| Acidification (mol H ⁺ eq) | 2,99E-03 | 1,34E-04 | 1,34E-04 | 3,26E-03 |
| Climate change - Biogenic (kg CO ₂ eq) | -1,79E+00 | 1,06E-05 | 8,82E-05 | -1,79E+00 |
| Climate change - Fossil (kg CO ₂ eq) | 7,07E-01 | 2,31E-02 | 7,00E-02 | 8,00E-01 |
| Climate change - Land use and LU change (kg CO ₂ eq) | 1,35E-02 | 8,45E-06 | 4,74E-05 | 1,36E-02 |
| Sum of Climate change (kg CO ₂ eq) | -1,07E+00 | 2,31E-02 | 7,01E-02 | -9,79E-01 |
| Ecotoxicity, freshwater - inorganics (CTUe) | 4,11E+00 | 7,82E-02 | 2,93E-01 | 4,48E+00 |
| Ecotoxicity, freshwater - metals (CTUe) | 2,41E+01 | 2,12E-01 | 4,20E-01 | 2,48E+01 |
| Ecotoxicity, freshwater - organics (CTUe) | 7,52E+00 | 1,99E-02 | 1,61E-03 | 7,54E+00 |
| Sum of Ecotoxicity, freshwater (CTUe) | 3,58E+01 | 3,10E-01 | 7,14E-01 | 3,68E+01 |
| Eutrophication, freshwater (kg P eq) | 1,72E-04 | 2,33E-07 | 2,04E-06 | 1,75E-04 |
| Eutrophication, marine (kg N eq) | 9,97E-04 | 4,71E-05 | 2,10E-05 | 1,07E-03 |
| Eutrophication, terrestrial (mol N eq) | 9,72E-03 | 5,20E-04 | 2,23E-04 | 1,05E-02 |
| Human toxicity, cancer - inorganics (CTUh) | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |

¹ Based on the amount of biogenic carbon dioxide that is fixed in the raw materials, the carbon content is calculated. $1.79 \text{ kg biogenic carbon dioxide} \times (12/44) = 0.488 \text{ kg carbon content}$.

² No packaging is taken into account in this LCA.



| | | | | |
|--|----------|----------|----------|----------|
| Human toxicity, cancer - metals (CTUh) | 1,13E-10 | 3,84E-12 | 4,47E-12 | 1,22E-10 |
| Human toxicity, cancer - organics (CTUh) | 1,12E-10 | 6,22E-12 | 9,67E-12 | 1,28E-10 |
| Sum of Human toxicity, cancer (CTUh) | 2,26E-10 | 1,01E-11 | 1,41E-11 | 2,50E-10 |
| Human toxicity, non-cancer - inorganics (CTUh) | 3,13E-09 | 6,56E-11 | 7,60E-11 | 3,27E-09 |
| Human toxicity, non-cancer - metals (CTUh) | 3,89E-09 | 2,39E-10 | 1,50E-10 | 4,27E-09 |
| Human toxicity, non-cancer - organics (CTUh) | 1,05E-09 | 3,59E-11 | 1,41E-11 | 1,10E-09 |
| Sum of Human toxicity, non-cancer (CTUh) | 8,02E-09 | 3,39E-10 | 2,29E-10 | 8,59E-09 |
| Ionising radiation (kBq U-235 eq) | 2,67E-02 | 1,46E-03 | 1,03E-03 | 2,92E-02 |
| Land use (Pt) | 2,13E+02 | 3,02E-01 | 6,02E-02 | 2,13E+02 |
| Ozone depletion (kg CFC11 eq) | 6,89E-08 | 5,09E-09 | 7,76E-09 | 8,18E-08 |
| Particulate matter (disease inc.) | 1,77E-08 | 2,07E-09 | 7,47E-10 | 2,05E-08 |
| Photochemical ozone formation (kg NMVOC eq) | 2,56E-03 | 1,48E-04 | 8,20E-05 | 2,79E-03 |
| Resource use, fossils (MJ) | 5,97E+00 | 3,48E-01 | 9,68E-01 | 7,28E+00 |
| Resource use, minerals and metals (kg Sb eq) | 3,82E-05 | 5,84E-07 | 5,75E-08 | 3,89E-05 |
| Water use (m ³ depriv.) | 3,96E-01 | 1,24E-03 | 4,74E-03 | 4,02E-01 |

Table 3: Environmental indicators derived from LCA per module of 1 kg of Anova® 1501 WMA according to EN15804.

| | A1 | A2 | A3 | Total A1-A3 |
|---|----------|----------|----------|-------------|
| Indicators describing use of primary resources | | | | |
| Energy, primary, renewable, excluding materials (RPR _E) (MJ) | 6.95E+00 | 4.36E-03 | 2.65E-02 | 6.99E+00 |
| Energy, primary, renewable, materials (RPR _M) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Energy, primary, non-renewable, excluding materials (NRPR _E) (MJ) | 2.31E+00 | 3.69E-01 | 1.07E+00 | 3.75E+00 |
| Energy, primary, non-renewable, materials (NRPR _M) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Indicators describing use of secondary resources | | | | |
| Secondary material (SM) (kg) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Secondary fuel, renewable (RSF) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Secondary fuel, non-renewable (NRSF) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Recovered energy (RE) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Mandatory inventory indicators | | | | |
| Abiotic depletion, fossil (ADPF) (MJ) | 1.13E-03 | 1.68E-04 | 5.26E-04 | 1.83E-03 |
| Water, fresh water use (FW) (m ³) | 3.50E-03 | 4.24E-05 | 1.51E-04 | 3.70E-03 |
| Waste, hazardous (HWD) (kg) | 3.13E-06 | 8.82E-07 | 9.91E-08 | 4.11E-06 |
| Waste, non-hazardous (NHWD) (kg) | 2.86E-02 | 2.21E-02 | 9.27E-04 | 5.16E-02 |
| Waste, radioactive (RWD) (kg) | 5.54E-06 | 2.28E-06 | 6.22E-07 | 8.45E-06 |
| Indicators describing output flows | | | | |
| Components for re-use (CRU) (kg) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for recycling (MFR) (kg) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Materials for energy recovery (MER) (kg) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Exported energy, thermal (EET) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Exported energy, electric (EEE) (MJ) | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |



1.6. References

1. ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedures. International Organization for Standardization, Geneva, Switzerland. <https://www.iso.org/standard/38131.html>.
2. ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services. International Organization for Standardization, Geneva, Switzerland. <https://www.iso.org/standard/61694.html>.
3. ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework. International Organization for Standardization, Geneva, Switzerland. <https://www.iso.org/standard/37456.html>.

