Environmental Product Declaration

GCP Applied Technologies

MIRA 110

According to
ISO 21930
ISO 14040/44

1. General Information

Manufacturer Name:	**GCP Applied Technologies Inc.** 62 Whittemore Avenue Cambridge, Massachusetts 02140 USA https://gcpat.com/en
Program Operator:	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959, USA https://www.astm.org/
Declaration Number:	EPD 760
Reference PCR:	ISO 21930 2017 serves as the core PCR
Date of Issuance:	July 31, 2024
End of Validity:	July 31, 2029
Product Name:	MIRA 110
EPD Owner:	GCP Applied Technologies
Declared Unit:	1000 kg of Admixture
EPD Scope:	Cradle-to-gate (A1, A2, and A3)
Verification:	Independent verification of the declaration according to ISO 14040 and ISO 21930. ☐ internal ☒ external
Prepared By:	Athena Sustainable Materials Institute
LCA Reviewer and EPD Verifier:	Anne Landfield Greig Principal, Four Elements Consulting, LLC anne@fourelementsllc.com

2. Product

2.1 Product Description and Application

Mira 110 is a mid-range water reducer. These concrete admixtures provide superior placeability and finishing for flatwork in commercial and high-end residential construction.

2.2 Base Materials

Product formulations were included in the LCA for peer review.

3. LCA Calculation Rules

3.1 Declared Unit

The declared unit is 1000 kg of MIRA 110 Admixture.

3.2 System Boundary

The system boundary for this study is limited to a cradle-to-gate focus. See section 4 for more technical information on the system boundary.

3.3 Estimates and Assumptions

All significant foreground data was gathered from the manufacturer based on measured values (i.e. without estimation).

3.4 Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary indicators of this standard. Conservative assumptions in combination with plausibility considerations and expert judgment were used to demonstrate compliance with these criteria.

3.5 Background Data

Data was gathered for the primary material and energy inputs used in production for calendar year 2015. Table 1 describe each LCI data source for raw materials (A1), transportation by mode (A2) and the core manufacture process (A3).

Table 1: Data sources

A1 Input	Process Name	Database
WAT-Water, Municipal	Tap water {RoW} |market for | Cut-off	Ecoinvent 3.7
JEPO (I)-Triethanola	Triethanolamine, at plant/RER with US electricity U	Ecoinvent 3.7
ZECTOL-DAZOMET 24% A	Chemicals inorganic, at plant/GLO with US electricity U Dewaterized	USEI
SKOL-SODIUM HYDROXID	Sodium hydroxide, 50% in H2O, production mix, at plant/RER with US electricity U	Ecoinvent 3.7
YESTER-Polyacrylate	Polyacrylamide {GLO}| production | Alloc Def, U (of project Ecoinvent 3 - allocation at point of substitution - unit)	Ecoinvent 3.7
JEFOW- Polymer w/Oxir	Chemicals inorganic, at plant/GLO with US electricity U	USEI
TBPH- TRIBUTL PHOSPHATE	Chemicals inorganic, at plant/GLO with US electricity U	USEI
CANAS-Calcium Nitrate	Chemicals inorganic, at plant/GLO with US electricity U	USEI
NACNSL-SODIUM THIOCY	Chemicals inorganic, at plant/GLO with US electricity U	USEI
DCI BULK (36%)	Chemicals inorganic, at plant/GLO with US electricity U	USEI
ZECTOL-DAZOMET 24% A	Chemicals inorganic, at plant/GLO with US electricity U	USEI
A2 Input	**Process Name**	**Database**
Trucking	Transport, combination truck, diesel powered/tkm/RNA	USLCI 2014
Rail	Transport, train, diesel powered/US	USLCI 2014
A3 Input	**Process Name**	**Database**
Electricity TRE NERC Region	Electricity, medium voltage {TRE}| market for | Alloc Def, U	Ecoinvent 3.7
Electricity SERC NERC Region	Electricity, medium voltage {SERC}| market for | Alloc Def, U	Ecoinvent 3.7
Natural Gas	Natural gas, combusted in industrial equipment NREL /RNA	USLCI 2014
Propane	Liquefied petroleum gas, combusted in industrial boiler NREL /US	USLCI 2014

Plastic Packaging	High density polyethylene resin, at plant NREL /RNA	USLCI 2014
Non-hazardous Waste	Disposal, emulsion paint, 0% water, to inert material landfill/CH with US electricity U	USEI
Hazardous Waste	Disposal, emulsion paint, 0% water, to inert material landfill/CH with US electricity U	USEI

3.6 Data Quality

Data quality was assessed as per ISO 14044 Section 4.2.3.6.2. This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used. Data quality is judged on the basis of its representativeness (technological, temporal, and geographical), completeness (e.g., unreported emissions), consistency and reliability.

Technical representativeness: Technical representativeness is the degree to which the data reflects the actual technology(ies) used. Core manufacturing process technology is derived from the manufacturing facilities and is highly representative. The secondary data for inputs to the manufacturing process are deemed to be reflective of typical or average technologies used by GCP in the production of admixtures. Some background material and process data are European but deemed to be similar to technologies used in the US.

Temporal representativeness: Temporal representativeness is the degree to which the data reflects the actual time (e.g. year) or age of the activity. Core manufacturing process data is very recent (2016). All other LCI data sources are less than 10 years old.

Geographical representativeness: Geographical representativeness is the degree to which the data reflects the actual geographic location of the activity (e.g. country or site). Geographical coverage of core manufacturing processes is the United States generally, and specific to the eGrid regions in which the facilities exist. Some material and process data are based on European sources (ecoinvent v3) while others are based on European data but modified where possible to incorporate North American upstream data (USEI).

Completeness: Completeness is the degree to which the data are statistically representative of the relevant activity. Core manufacturing processes are very complete and were derived from data gathered at the participating facilities. These data reflect annual operations inclusive of seasonal and other normal annual fluctuations in operations. All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared products. The relevant background materials and processes were taken from the US LCI Database (adjusted for known data placeholders); USEI Database; US system boundary adjusted Ecoinvent v3.7 LCI databases and modeled in SimaPro software v.8.0.1, 2014. Efforts were made to ensure that all data used was as complete as reasonably possible.

Reliability: Reliability is the degree to which the sources, data collection methods and verification procedures used to obtain the data are dependable. For core manufacturing processes the reliability of the information and data is deemed to be very good as these were derived from specific data of the production facilities. All missing process data (dummies) associated with the US LCI data have been consistently filled. All other LCI data have been incorporated from reputable databases.

Precision: GCP, through measurement and calculation, collected primary data on their annual production of admixture products. The exact energy consumption at the facilities and the exact product formulations were incorporated into the study.

Consistency: To ensure consistency, the LCI modeling of the production weighted input and output LCI data for the declared products used the same modeling structure across the respective product systems, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, emissions to air, water and soil, and waste recycling and treatment. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted.

Reproducibility: Internal reproducibility is possible since the data are stored in an available database as well as the calculations that were performed in the excel spreadsheet. A considerable level of transparency is provided throughout the report as the specifications and material quantity make-up for the declared products are presented.

3.7 Period under Review

Data was gathered for the primary material and energy inputs used in the production for calendar year 2016.

3.8 Allocation

"Mass" was deemed as the most appropriate physical parameter for allocation used for the admixture manufacturing system to calculate the input energy flows (electricity, natural gas and propane), packaging materials and waste flows per declared unit of 1,000 kg of product output.

3.9 Comparability

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used. EPDs are comparable only if they comply with this document, use the same sub-category PCR (ISO 21930:2017) where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

4. Technical Information

The various processes that occur at each stage are classified and grouped in information modules (or simply "modules"), labeled with alpha-numeric designations "A1" through "C4". A declared unit is defined for LCAs covering "cradle-to-gate", or the production stage (shown Table 4), which consists of three modules: A1 Raw Material Supply; A2 Transport (to the manufacturer); and A3 Manufacturing. This study focuses on the product stage only and no Module D credits or burdens are included in the assessment.

The **Product stage** includes the following processes:

- **A1 Raw Material Supply** [1]: Extraction and processing of input raw materials (see Table 3, weighted average plant generic formulations for eight admixture products, including fuels used in extraction and transport within the process.
- **A2 Transport** [1]: Weighted average transportation of raw materials from extraction site or source to manufacturing site and including empty backhauls and transportation to interim distribution centers or terminals.
- **A3 Manufacturing** [1]: Manufacturing of the admixture products, including all energy and materials required and all emissions and wastes produced. This includes:

- Packaging, including transportation and waste disposal, to make admixtures ready for shipment;

- Average transportation from manufacturing site to landfill for on-site wastes, including empty backhauls and the waste disposal process.

The A3 module includes material handling and product mixing, lighting and heating, ventilation and air conditioning (HVAC), operation of environmental equipment (baghouses and bin vents), on-site transportation (loading and unloading) and storage of products.

The **Product Stage** excludes the following processes [1]:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure;
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment;
- Personnel-related activities (travel, furniture, and office supplies); and
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

Table 2: Description of the System Boundary (x: included in LCA; mnd: module not declared)

Product			Construction Installation		Use							End-of-life				Benefits of Loads Beyond the System Boundary		
Raw Material supply	Transport	Manufacturing	Transport	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
x	x	x	mnd	mnd	mnd	mnd	mnr	mnr	mnr	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd

5. LCA: Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics.Table 5 below summmarizes the LCA results for the cradle-to-gate (A1-A3) product system.

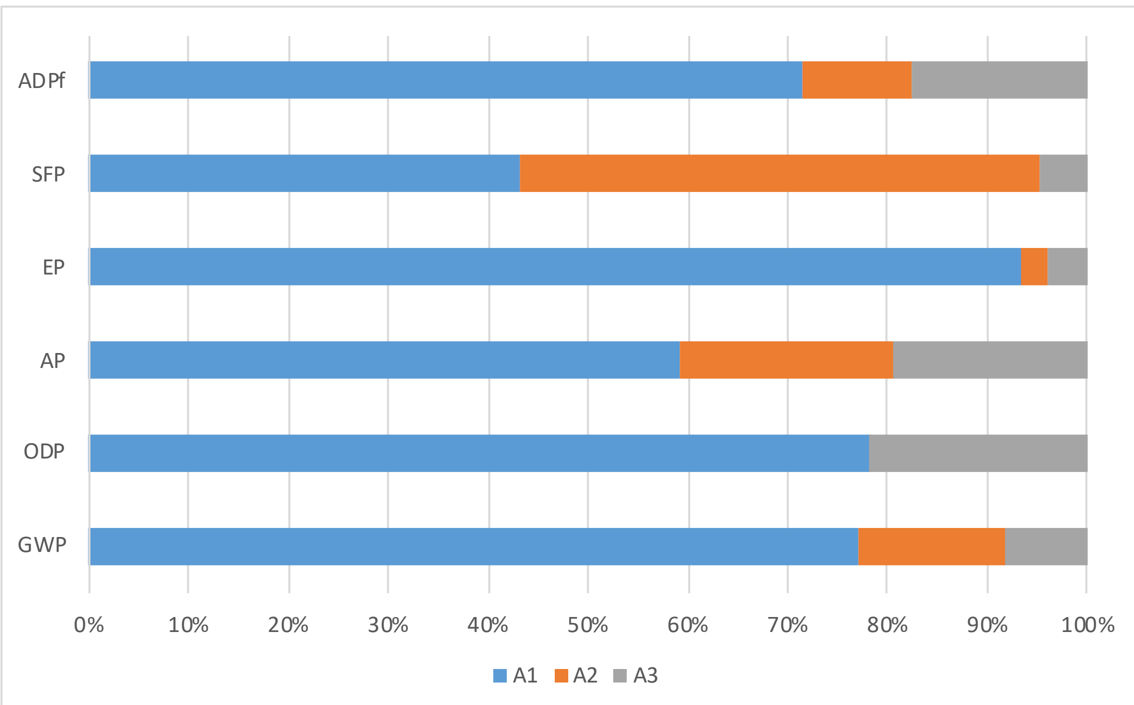
Table 3: Product Stage LCA Results for MIRA 110							
CALCULATED RESULTS A1-A3 PER 1000 kg							
Core Mandatory Impact Indicator			**Total**	**A1**	**A2**	**A3**
Global warming potential	GWP	kg CO2e	1.32E+03	1.02E+03	1.91E+02	1.11E+02
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	8.76E-05	6.85E-05	7.96E-09	1.92E-05
Acidification potential of soil and water sources	AP	kg SO2e	9.44E+00	5.59E+00	2.01E+00	1.83E+00
Eutrophication potential	EP	kg Ne	4.28E+00	3.99E+00	1.19E-01	1.67E-01
Formation potential of tropospheric ozone	SFP	kg O3e	9.69E+01	4.19E+01	5.04E+01	4.65E+00
Abiotic depletion potential for fossil resources	ADPf	MJ, NCV	2.47E+04	1.77E+04	2.71E+03	4.35E+03
Abiotic depletion potential for non-fossil mineral resources	ADPe	kg Sbe	3.01E+03	2.33E+03	1.04E+01	6.68E+02
Use of Primary Resources			**Total**	**A1**	**A2**	**A3**
Renewable primary energy carrier used as energy	RPRE	MJ, NCV	4.11E+02	3.99E+02	0.00E+00	1.25E+01
Renewable primary energy carrier used as material	RPRM	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable primary energy carrier used as energy	NRPRE	MJ, NCV	2.80E+04	2.03E+04	2.87E+03	4.85E+03
Non-renewable primary energy carrier used as material	NRPRM	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Secondary Material, Secondary Fuel and Recovered Energy			**Total**	**A1**	**Total**	**A1**
Secondary material	SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable secondary fuel	RSF	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuel	NRSF	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy	RE	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mandatory Inventory Parameters			**Total**	**A1**	**A2**	**A3**
Consumption of freshwater resources	FW	m3	8.79E+00	8.70E+00	0.00E+00	8.61E-02
Indicators Describing Waste			**Total**	**A1**	**A2**	**A3**
Hazardous waste disposed	HWD	kg	4.06E+00	0.00E+00	0.00E+00	4.06E+00
Non-hazardous waste disposed	NHWD	kg	1.60E-01	0.00E+00	0.00E+00	1.60E-01
High-level radioactive waste, conditioned, to final repository	HLRW	m3	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Intermediate- and low-level radioactive waste, to final repository	ILLRW	m3	5.54E-06	5.03E-06	1.17E-07	3.96E-07
Components for re-use	CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	MR	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
Recovered energy exported from the product system	EE	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* The declared product does not contain any biogenic carbon.

6. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. The impact categories global warming potential, ozone depletion potential, eutrophication potential, acidification potential, abiotic depletion potential, and smog creation potentialmaterials are dominated by A1: raw material supply. These impacts are caused by the upstream production of the material inputs into the admixtures and account for most of impacts in the various impact categories.

Figure 1. Contribution Analysis: A1-A3 MIRA 110



7. Additonal Environmental Information

Substances of high concern are chemicals that may have serious effects on human health and the environment. No substances of high concern are indentifed in the declared product.

8. References

1. American Center for Life Cycle Assessment. (May 2019). ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017
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