

Environmental Product Declaration



CR Minerals

Tephra RFA-Pueblo Pozzolan



ASTM INTERNATIONAL

According to
ISO 21930
ISO 14025

1. General Information

Manufacturer Name: CR Minerals – 3345 Lime Rd. Pueblo, CO 81004

Program Operator: ASTM International
100 Barr Harbor Drive
West Conshohocken, PA
19428-2959, USA

Declaration Number: EPD 337

Reference PCR: ISO 21930: 2017

Date of Issuance: June 27, 2022

End of Validity: June 27, 2027

Product Name: Tephra RFA-Pueblo Pozzolan

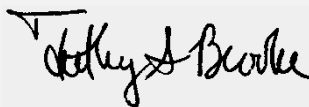
EPD Owner: CR Minerals

Declared Unit: 1 metric ton of Tephra RFA-Pueblo Pozzolan

EPD Scope: Cradle-to-gate (A1, A2, and A3)

Verification: ISO 21930 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930. ☐ internal
☒ external

LCA Reviewer and EPD Verifier: Timothy S. Brooke
ASTM International



2. Product

2.1 Product and Company Description

CR Mineral is a producer of high quality natural pozzolan (NP) in Pueblo CO. This natural pozzolan, mined from a volcanic rock deposit and milled to a fine powder in Pueblo CO is blended with flyash to produce an ASTM C-618 Class F pozzolan called Tephra RFA-Pueblo (RFA = Recycled Fly Ash). It can be substituted for a Class F flyash. The product is used primarily in the concrete production industry and the oil and gas industry. The product can reduce cement content in concrete mixes, and provides enhanced durability of a concrete mixture through mitigation of alkali -silica reactivity (ASR) and increased sulfate resistance, permeability reduction, and increased long term compressive and flexural strength.

3. LCA Calculation Rules

3.1 Declared Unit

The declared unit is 1 metric ton of Tephra RFA-Pueblo Pozzolan produced at CR Minerals's manufacturing facility.

3.2 System Boundary

The system boundary for this study is limited to a cradle-to-gate focus. (see also Table 4):

- ☐ **A1 Raw material supply:** Extraction, handling, and processing of input materials.
- ☐ **A2 Transportation:** Transportation of all input materials from the suppliers to the gate of the manufacturing facility.
- ☐ **A3 Manufacturing:** The preparation processes of CR Minerals' manufacturing facility. This phase also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

3.3 Estimates and Assumptions

All significant foreground data was gathered from the manufacturer based on measured values.

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.

3.5 Background Data and 3.6 Data Quality

Data was gathered for the primary material and energy inputs used in production for calendar year 2021. Table 1 describes each LCI data source for raw materials (A1), transportation (A2) and the core manufacture process (A3). Table 3 also includes a data quality assessment for on the basis of the technological, temporal, and geographical representativeness.

Table 1: Secondary Data Sources and Data Quality Assessment

A1: Raw Material Inputs

Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Natural Pozzolan	Ecoinvent 3.7: Gravel crushed {RoW} production Alloc Rec U - NRMCA , Electricity modified with WECC Grid	US	2018	Technology: good Time: very good Data is <5 years old Geography: very good Data is representative of grid specific conditions.
Fly Ash	No Burden	Global	2021	Technology: very good Time: very good Data is <5 years old Geography: very good

A2: Transportation

Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Trucking	USLCI: Transport, single unit truck, short-haul, diesel powered, Northwest/tkm/RNA	North America	2014	Technology: very good Time: good Data is <10 years old Geography: good

A3: Manufacturing				
Energy	LCI Data Source	Geography	Year	Data Quality Assessment
Electricity	ecoinvent 3.7: Electricity, medium voltage, at grid, [WECC]	US	2018	Technology: very good Time: good Data is <5 years old Geography: very good
Natural Gas	USLCI: Natural gas, combusted in industrial boiler/US	US	2014	Technology: very good Time: good Data is <10 years old Geography: very good.
Diesel (Fuel)	USLCI: Diesel, combusted in industrial equipment/US	US	2014	Technology: very good Time: good Data is <10 years old Geography: very good.
Oil	USLCI: Residual fuel oil, combusted in industrial boiler/US	US	2014	Technology: very good Time: good Data is <10 years old Geography: very good.
Freshwater Consumed	Ecoinvent 3.7: Tap water {RoW} market for Cut-off	Global	2014	Technology: very good Time: good Data is <10 years old Geography: good

3.7 Period under Review

Data was gathered for the primary material and energy inputs used in the production for calendar year 2021.

3.8 Allocation

At CR Minerals several different products are produced. Since the primary data for manufacturing was only available on a facility level, the environmental load among the products produced is allocated according to its mass. For waste that is recycled, the 'recycled content approach' was chosen. The recycling of waste generated by the product system is cut off.

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.

4. 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 2 and 3 below summarize the LCA results for the cradle-to-gate (A1-A3) product system.

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

Product			Construction Installation		Use							End-of-life				Benefits 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

Table 3. LCIA Results for 1 metric ton Tephra RFA-Pueblo Pozzolan						
Environmental Indicator	Abbreviation	Units	Total	A1	A2	A3
Core Mandatory Impact Indicator						
Global warming potential	GWP	kg CO ₂ -eq	5.58E+01	5.07E+01	2.74E-02	5.07E+00
Depletion potential of the stratospheric	ODP	kg CFC-11-	3.58E-06	3.27E-06	1.14E-12	3.09E-07
Acidification potential of land and water	AP	kg SO ₂ -eq	2.32E-01	2.08E-01	2.87E-04	2.40E-02
Eutrophication potential	EP	kg PO ₄ -eq	3.75E-01	3.43E-01	1.71E-05	3.26E-02
Formation of tropospheric ozone	SFP	Kg O ₃ -eq	5.15E+00	4.56E+00	7.20E-03	5.85E-01
Abiotic depletion potential for fossil	ADPF	MJ Surplus	6.73E+02	6.11E+02	3.88E-01	6.17E+01
Fossil Fuel Depletion	FFD	MJ Surplus	6.16E+01	5.57E+01	0.00E+00	5.89E+00
Use of Primary Resources						
Renewable primary energy carrier used as energy	RPRE	MJ	1.51E+02	1.38E+02	0.00E+00	1.30E+01
Renewable primary energy carrier used as material	RPRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable primary energy used as energy	NRPRE	MJ	8.44E+02	7.67E+02	4.11E-01	7.65E+01
Non-renewable primary energy used as material	NRPRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Secondary Material, Secondary Fuel and Recovered Energy						
Use of secondary materials	SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	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 Parameters						
Use of freshwater resources	FW	m ³	2.14E-01	1.89E-01	0.00E+00	2.50E-02
Indicators Describing Waste						
Disposed of hazardous waste	HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of non-hazardous waste	NHWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of high-level radioactive waste	HLRW	m ³	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Disposed of low-level radioactive waste	LLRW	m ³	5.77E-08	5.27E-08	0.00E+00	4.97E-09
Components for reuse	CRU	kg	5.42E-07	4.95E-07	0.00E+00	4.67E-08
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
Recovered energy exported	EE	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00

5. Interpretation

Figure 1 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. For all impact categories the biggest contribution comes from the A3 raw material phase closely followed by the A1 manufacturing phase. Majority of the A1 impacts come from the upstream manufacturing of the Tephra NP-Pueblo Pozzolan product.

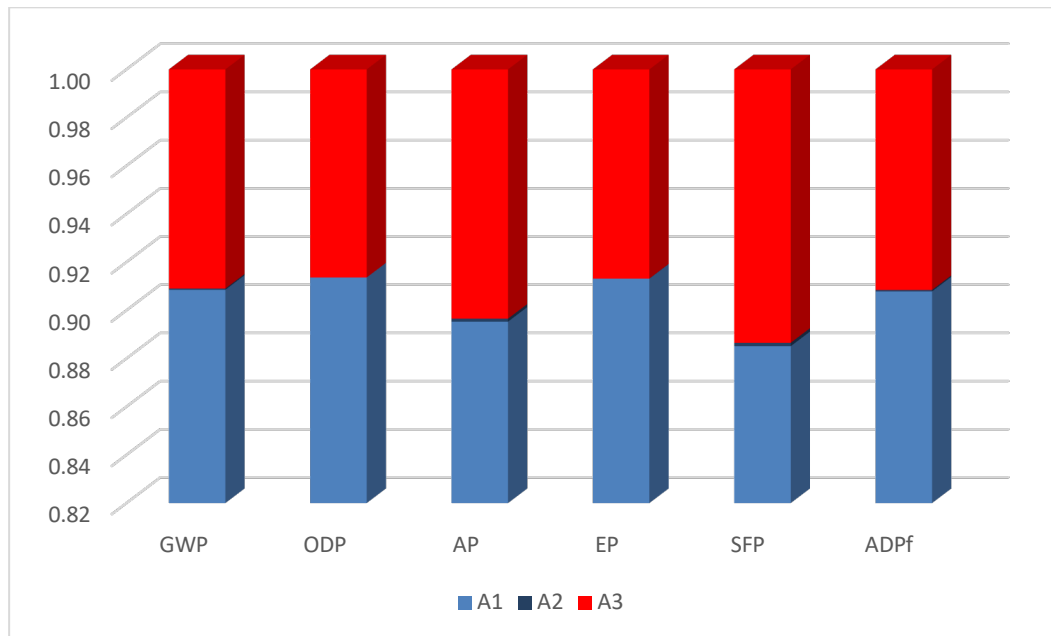


Figure 1. Contribution analysis for Tephra RFA-Pueblo Pozzolan

6. References

1. ASTM 2020 - ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) General Program Instructions v8, April 29th.
2. Athena Institute: 2021 - A Cradle-to-Gate Life Cycle Assessment of Tephra RFA-Pueblo Pozzolan and Tephra NP-Pueblo Pozzolan Manufactured by CR Minerals.
3. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.
4. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
5. ISO 14044:2006/AMD 1:2017/ AMD 2:2020 - Environmental management - Life cycle assessment - Requirements and guidelines.
6. 14040:2006/AMD 1:2020 - Environmental management - Life cycle assessment - Principles and framework.