



## Environmental Product Declaration

This document is a product-specific Type III Environmental Product Declaration (EPD) for a Volcanic Ash produced naturally and processed Geofortis's Utah Plant, located at 1345 K Ave., Tooele UT 84074.

# Geofortis

## Environmental Product Declaration

### General Information

This cradle to gate Environmental Product Declaration covers (volcanic ash) processed by Geofortis meeting the ASTM C618 specification for FlyAsh for Use in Concrete (ASTM, 2020). This study was conducted in accordance with ISO 14040 (ISO 14040, 2006), and 14044 (ISO 14044, 2006) and the requirements of the ISO 21930 (ISO 21930, 2017). ISO 21930 (ISO 21930, 2017) provides the core rules for the Type III Environmental Product Declaration (EPD) produced from this study. No PCR has been developed for natural pozzolans meeting ASTM C618 specification.

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Independent verification of the declaration and data, according to ISO 14025:  
☐ internal      ☒ external

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### Product Description

Volcanic ash, a natural pozzolan produced from volcanic ash by Geofortis, was evaluated in this study.



**Figure 1: Natural pozzolan, finished product.**

Production of volcanic ash starts with mining of volcanic ash in the form of fine sand. The volcanic ash is then dried using natural gas and fed into an electric driven ball mill. This process ensures that the product is a properly sized fine white powder which fulfills the requirements of ASTM C618 Class N.

### **The natural pozzolan volcanic ash is produced at:**

Geofortis

1345 K Ave, Tooele, Utah 84074

**Declared Unit:** 1 metric ton of natural pozzolan volcanic ash.

**Product Components:** 100% volcanic ash

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### System boundary

This study is cradle-to-gate covering A1-A3 stages of the life cycle as illustrated in Figure 3.

- **A1 – Raw Material Supply** (upstream processes): Extraction, handling, and processing of the materials (including fuels) used in the production of volcanic ash.
- **A2 – Transportation:** Transportation of these materials from the supplier to the ‘gate’ of the Tooele, UT Plant.
- **A3 – Manufacturing** (core processes): Manufacturing of the product including grinding, waste handling, and treatment.

PRODUCTION Stage (Mandatory)			CONSTRUCTION Stage		USE Stage					END-OF-LIFE Stage			
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction/ Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 2: Life-cycle stages and modules

Note: MND = module not declared; X = module included.

### LCA study

Except as noted above, all other life cycle stages as described in Figure 2 are excluded from the LCA study. The following processes are also excluded from the study:

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

The main processes included in the system boundary are illustrated in Figure 3.

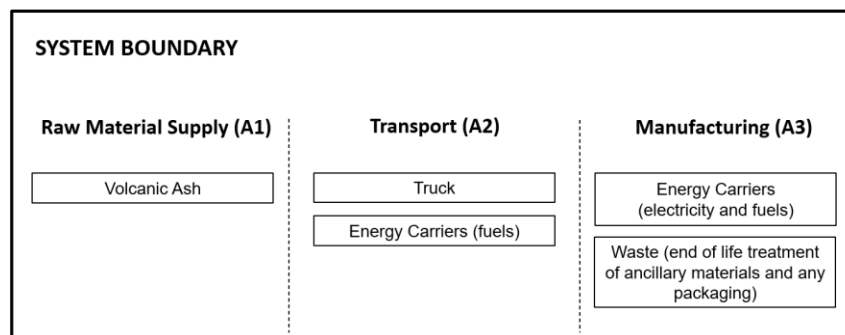


Figure 3: System Boundary for study

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Electricity impacts are calculated based on electricity provided at the grid of the NERC region WECC in 2021. The resource mix for WECC region is coal 17.16%, natural gas 34.16%, petroleum 0.11%, nuclear 7.72%, hydro 19.31%, biomass 1.2%, geothermal 2.12%, solar 7.78%, wind 9.97%, others 0.42%. The GWP for Geofortis's Toole Plant is 0.37 kg CO<sub>2</sub>e/kWh.

### Allocation procedure

This study follows the rules of ISO 14044, 2006 section 4.3.4, avoiding allocation wherever possible, and when allocation cannot be avoided, partitioning impacts based on physical causality. Recycling procedures follow the rules of the ISO 21930:2017 Section 7.2.6 (ISO 21930, 2017). Volcanic ash is treated as recovered material and thus the environmental impacts allocated are limited to the treatment and transportation required to use as a natural pozzolan material input.

### Cutoff criteria

All inputs and outputs to a unit process have been included in the calculation, for which data are available. Data gaps have been filled by conservative assumptions with average or generic data. Any assumptions for such choices have been documented. When data was not reasonably available, the following cutoff criteria were used:

- Mass | If a flow is less than 1% of the cumulative mass of the model flows, it may be excluded, provided its environmental relevance is minor.
- Energy | If a flow is less than 1% of the cumulative energy of the system model, it may be excluded, provided its environmental relevance is minor.
- Environmental relevance | Material and energy flows known or expected to have the potential to cause environmentally relevant emissions into air, water, or soil related to the environmental indicators of the PCR shall be included unless justification for exclusion is documented.

The total of neglected input flows is less than 1% of energy usage and mass.

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### Life Cycle Impact Assessment Results

**Table 1: Cradle to Gate (A1-A3) impact results of volcanic ash<sup>1</sup> per metric tonne\*\***

Impact Assessment	Unit	A1	A2	A3	TOTAL
Global warming potential (GWP)	kg CO <sub>2</sub> e	0.74	25.8	60.8	87.4
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 e	1.17E-07	1.08E-09	2.46E-06	2.58E-06
Eutrophication potential (EP)	kg N e	0.01	0.02	0.25	0.27
Acidification potential of soil and water sources (AP)	kg SO <sub>2</sub> e	0.00	0.26	0.29	0.56
Formation potential of tropospheric ozone (POCP)	kg O <sub>3</sub> e	0.06	6.51	2.06	8.63
<b>Resource Use</b>					
Abiotic depletion potential for fossil resources (ADP <sub>fossil</sub> )	MJ, NCV	8.87E-09	0.00	2.96E-06	2.97E-06
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	13.2	366	818	1,198
Renewable primary resources as material, (RPRM)*	MJ, NCV	0.39	0.00	148	149
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	15.9	366	921	1,303
Consumption of fresh water	m3	0.00	0.00	0.00	0.00
<b>Secondary Material, Fuel and Recovered Energy</b>					
Secondary Materials, (SM)*	kg	0.00	0.00	0.00	0.00
Renewable secondary fuels, (RSF)*	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)*	MJ, NCV	0.00	0.00	0.00	0.00
Recovered energy, (RE)*	MJ, NCV	0.00	0.00	0.00	0.00
<b>Waste &amp; Output Flows</b>					
Hazardous waste disposed*	kg	0.00	0.00	0.00	0.00
Non-hazardous waste disposed*	kg	0.00	0.00	0.58	0.58
High-level radioactive waste*	m3	1.89E-09	0.00	5.38E-08	5.56E-08
Intermediate and low-level radioactive waste*	m3	9.87E-09	0.00	5.04E-07	5.14E-07
Components for reuse*	kg	0.00	0.00	0.00	0.00
Materials for recycling*	kg	0.00	0.00	0.24	0.24
Materials for energy recovery*	kg	0.00	0.00	2.94E-03	2.94E-03
Recovered energy exported from the product system*	MJ	0.00	0.00	0.00	0.00

\* Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories.

\*\*Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products.

<sup>1</sup> These products contain no materials that are considered hazardous as defined by the PCR.

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Life cycle impact assessment (LCIA) results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks.

EPDs are comparable only if they comply with this document, 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.

### LCA Interpretation

Most volcanic ash impacts come from the A3 life cycle stage. Electricity from the grinding operation is the primary source of global warming potential (GWP) impacts for this stage.

### References

ACLCA (2019): *ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017*.

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