

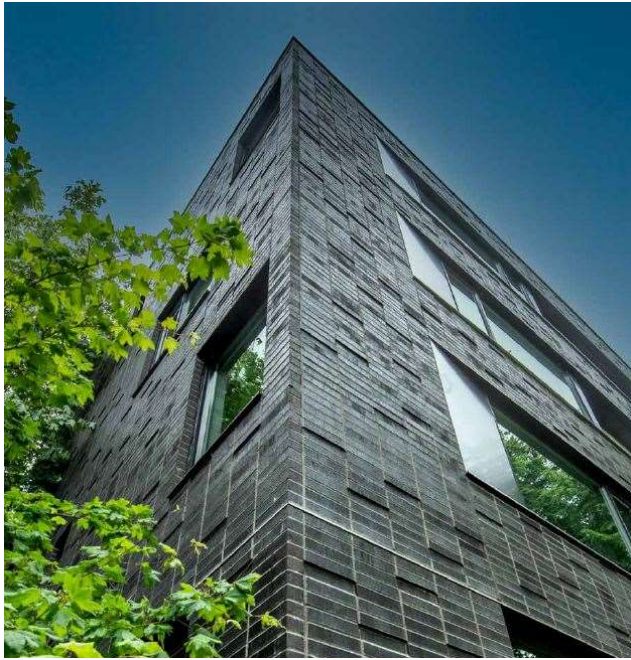
## MUTUAL MATERIALS

ENVIRONMENTAL PRODUCT DECLARATION

Brick: Columbia Plant



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## Environmental Product Declaration

This document is a product-specific Type III Environmental Product Declaration (EPD) for clay bricks and clay brick pavers produced in Mutual Material's Columbia Plant, located in 2300 SE Hogan Rd, Gresham, Oregon, USA.

# Environmental Product Declaration

## General Information

This study has been performed according to the requirements of the ASTM International Product Category Rule (PCR) for Clay Bricks, Clay Brick Pavers, and Structural Clay Tile (NSF/ASTM, 2016-v3 2022). This study was conducted in accordance with ISO 14025 (ISO 14025, 2006), ISO 14040 (ISO 14040, 2006), ISO 14044 (ISO 14044, 2006), and ISO 21930 (ISO 21930, 2017).

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

### Program Operator:

ASTM International

<http://www.astm.org/EPDs.htm>



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**Declared Unit:** 1 cubic meter (m<sup>3</sup>)

### Date of Issue:

August 29, 2023 (valid for 5 years until August 28, 2028)





**ASTM Declaration Number:** EPD-540



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Four brick types were evaluated in this study: face bricks, structural bricks, thin bricks and pavers. Their technical profile is depicted in **Table 1**.

**Table 1: Brick types product description**

Product Type	Standard	Description	Product Image/Descriptions
Face Brick	ASTM C216	Used for building interior and exterior walls, columns, piers, partitions, footings and other load-bearing structures.	
Structural Brick	ASTM C652	Used in walls, columns, beams and piers. Bricks are intended to be reinforced and grouted. Commonly used to resist loads due to gravity, wind, earthquake, blast, ballistic and fire.	
Thin Brick	ASTM C1088	Typically used in Precast and adhered applications	
Pavers	ASTM C902	Used in public settings to construct sidewalks, also in private settings, they are used in building walkways and patios.	

Material Composition: clay/shale aluminum silicates (90-95%), manganese dioxide (<3%), chromite (<3%) and barium carbonite (<1%).

## System boundary

This study captures the following mandatory cradle-to-gate (A1-A3) life cycle product stages (as illustrated in Figure 2):

**A1 – Raw Material Supply** (upstream processes): Extraction and processing of raw materials, including fuels used in extraction and transport within the process and any crushing or grinding required for transport.

**A2 – Transportation:** Average or specific transportation of raw materials (including recycled or recovered materials) from extraction site or source to manufacturing site and including empty backhauls and transportation to intermediate distribution centers or terminals.

**A3 – Manufacturing** (core processes): Manufacturing of the product including:

- Clay Mining
- Size Reduction and Screening;
- Forming and cutting;
- Coating or glazing extruding, forming, cutting and glazing the bricks;
- Drying;

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- Firing and cooling;
- Transportation of pre-consumer wastes and unutilized by-products from manufacturing site to recycling/reuse/landfill, including empty backhauls; and
- Recycling/recovering/reuse/energy recovery of pre-consumer wastes and by-products from production.

PRODUCTION Stage <i>(Mandatory)</i>			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
<b>A1</b>	<b>A2</b>	<b>A3</b>	<b>A4</b>	<b>A5</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B4</b>	<b>B5</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>

**Figure 1. Life-Cycle Stages and Modules**

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:

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

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

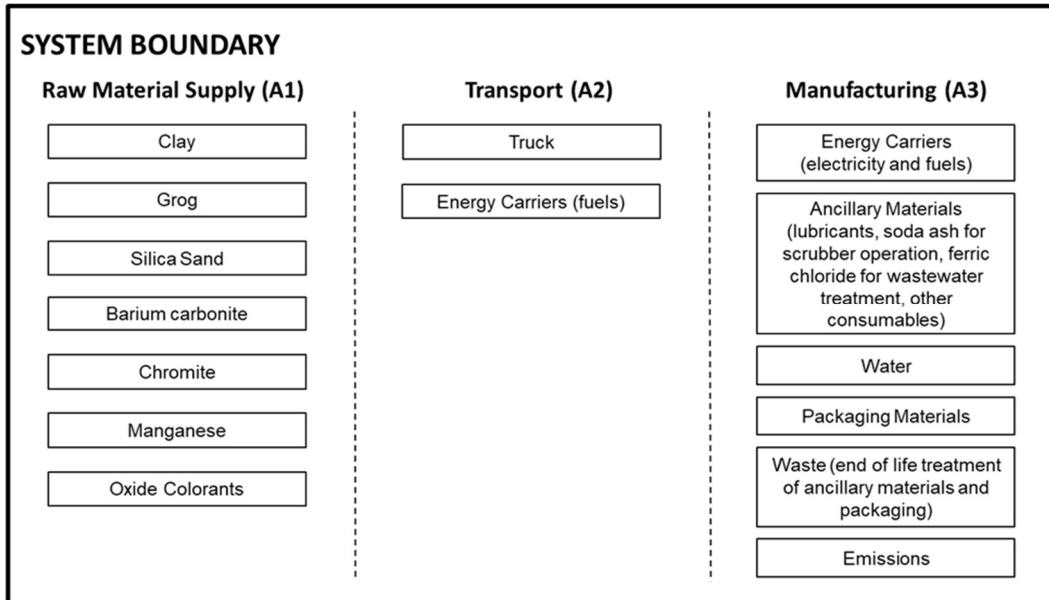


Figure 2: Main processes included in system boundary.

## Life Cycle Inventory

Primary data was collected from Columbia manufacturing facility for the 2021 calendar year.

Secondary life cycle inventory (LCI) data used to conduct this study are the best available. Where company or supplier-specific LCI data was not available, representative processes were selected from the US-EI database v2.2.3 (Long Trail Sustainability, 2016) and (Long Trail Sustainability, 2021) or the ecoinvent 3.8 allocation, cut-off by classification databases (ecoinvent, 2021).

Electricity impacts are calculated based on the 2021 resource mix at the level of North American Electricity Reliability Council (WECC) region. Fuel mix for WECC: natural gas 34.2%, coal 17.2%, hydro 19.3%, wind 10.0%, solar 7.8%, nuclear 7.7%, geothermal 2.2%, other 1.6%.

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## Environmental Impacts

Cradle to Gate (A1-A3) impact results are outlined in **Table 1**. Results are displayed per cubic meter (m<sup>3</sup>), the declared unit<sup>1</sup>. These results represent an average performance for the four brick types presented.

Table 2: Impact results per m3 for average Columbia Plant brick

Impact Assessment	Unit	A1	A2	A3	Total
Global warming potential (GWP) <sup>2</sup>	kg CO <sub>2</sub> e	34.2	8.45	650	<b>693</b>
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 e	0.00	0.00	0.00	<b>0.00</b>
Eutrophication potential (EP)	kg N e	0.11	0.01	0.45	<b>0.57</b>
Acidification potential of soil and water sources (AP)	kg SO <sub>2</sub> e	0.15	0.12	1.65	<b>1.91</b>
Formation potential of tropospheric ozone (POCP)	kg O <sub>3</sub> e	2.80	2.99	20.1	<b>25.9</b>
<b>Resource Use</b>					
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb e	0.00	0.00	0.00	<b>0.00</b>
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	318	120	10183	<b>10621</b>
Renewable primary energy resources as energy (fuel), (RPRE <sup>3</sup> )*	MJ, NCV	53.44	0.00	590.06	<b>643.50</b>
Renewable primary resources as material, (RPRM <sup>10</sup> )*	MJ, NCV	0.00	0.00	0.00	<b>0.00</b>
Non-renewable primary resources as energy (fuel), (NRPRE <sup>10</sup> )*	MJ, NCV	457	120	10423	<b>11000</b>
Non-renewable primary resources as material (NRPRM <sup>10</sup> )*	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Consumption of fresh water, (FW <sup>10</sup> )	m <sup>3</sup>	0.82	0.00E+00	1.17	<b>1.99</b>
<b>Secondary Material, Fuel and Recovered Energy</b>					
Secondary Materials, (SM <sup>10</sup> ) *	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Renewable secondary fuels, (RSF <sup>10</sup> ) *	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Non-renewable secondary fuels (NRSF <sup>10</sup> ) *	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Recovered energy, (RE <sup>10</sup> ) *	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>Waste &amp; Output Flows</b>					
Hazardous waste disposed, (HW <sup>10</sup> ) *	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Non-hazardous waste disposed, (NHWD <sup>10</sup> ) *	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
High-level radioactive waste, (HLRW <sup>10</sup> ) *	m <sup>3</sup>	8.46E-08	0.00E+00	9.94E-08	<b>1.84E-07</b>
Intermediate and low-level radioactive waste, (ILLRW <sup>10</sup> ) *	m <sup>3</sup>	7.93E-07	0.00E+00	1.00E-06	<b>1.79E-06</b>
Components for reuse, (CRU <sup>10</sup> ) *	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for recycling, (MR <sup>10</sup> ) *	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for energy recovery, (MER <sup>10</sup> ) *	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Recovered energy exported from the product system, (EE <sup>10</sup> ) *	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>

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

<sup>2</sup> GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5). CO<sub>2</sub> from biogenic secondary fuels used in kiln are climate-neutral (CO<sub>2</sub> sink = CO<sub>2</sub> emissions), ISO 21930, 7.2.7.

<sup>3</sup> Calculated per ACLCA ISO 21930 Guidance.



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This EPD only covers the cradle-to-gate impacts of bricks using a declared unit and the results cannot be used to compare between products. EPDs from different programs (using different PCR) may not be comparable.

Explanatory materials may be requested by contacting:

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## Additional Environmental Information

Since bricks are sold in sq foot by coverage, this equivalence table is presented to depict the link between the presented unit (m3) and the sq foot equivalence.

Table 3: Square Meter coverage of various Mutual Material brick types

Brick Type	ASTM	Dimensions			SF Veneer Wall Coverage/m3
		Depth	Height	Length	
Modular	C-216 C-652	3.625"	2.25"	7.625"	163.5
Standard	C-216 C-652	3.5"	2.5"	7.5"	155.0
448	C-216 C-652	3.5"	3.5"	7.5"	147.6
Norman	C-216 C-652	3.5"	2.5"	11.5"	151.6
Econ	C-216 C-652	3.5"	3.5"	11.5"	144.4
Slim Brick Std	C1088	0.625"	2.5"	7.5"	867.9
Slim Brick Mod*	C1088	0.625"	2.25"	7.625"	843.1

\*note coverage for slim brick varies by color





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## References

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