Environmental **P**roduct **D**eclaration

The Shaw Group – Shaw Brick

Clay Brick

ASTM INTERNATIONAL

According to
ISO 21930
ISO 14025

1. General Information

Manufacturer Name: Shaw Brick - Nova Scotia Trunk 2, Lantz, NS B2S 1M9

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

Declaration Number: EPD 359

Reference PCR: Clay Brick, Clay Brick Pavers, and Structural Clay Tile (UNCPC 3731 and 3735)

Date of Issuance: September 20, 2022

End of Validity: September 20, 2027

Product Name: Clay Brick

EPD Owner: Shaw Brick

Declared Unit: 1 m^3 of Clay Brick

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 Information

2.1 Company Description

The Shaw Group is a leading manufacturing company in Eastern Canada with a focus on products for the construction industry. Shaw Group produces close to 1,000 indiviudal products across 12 facilities in Altantic Canada. The company operates through a number of divisions and subsidiaries including Shaw Brick. Shaw Brick was founded in 1861 and is a distributor and retailer of high-quality clay brick, concrete block, and natural stone products.

2.2 Product Description

This EPD reports environmental transparency information for Clay Brick produced at the Shaw Brick facility in Lantz, Nova Scotia. The declared product studied in this EPD is Clay Brick. Shaw Brick produces clay brick in a wide variety of colours including black, brown, buff, grey, red, and white. Figure 1 provides visual representations of clay brick in a variety of colours produced at the facility. The products are available in face brick, building brick, paving brick, and thin brick types and align with the standards listed in Table 1. The formulation for these clay brick products is nearly identical except for small variances in additives. Therefore, this EPD studies a clay brick product that is representative of all of these types.

Table 1: Relevant Standards and Specifications for the Product

Product	Standard
Face Brick	ASTM C16 Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) CSA A82 Fired masonry brick made from clay or shale
Building Brick	ASTM C62 Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale) CSA A82 Fired masonry brick made from clay or shale
Paving Brick	ASTM C902 Standard Specifications for Pedestrian and Light Traffic Paving Brick
Thin Brick	ASTM C1088 Standard Specification for Thin Veneer Brick Units Made from Clay or Shale

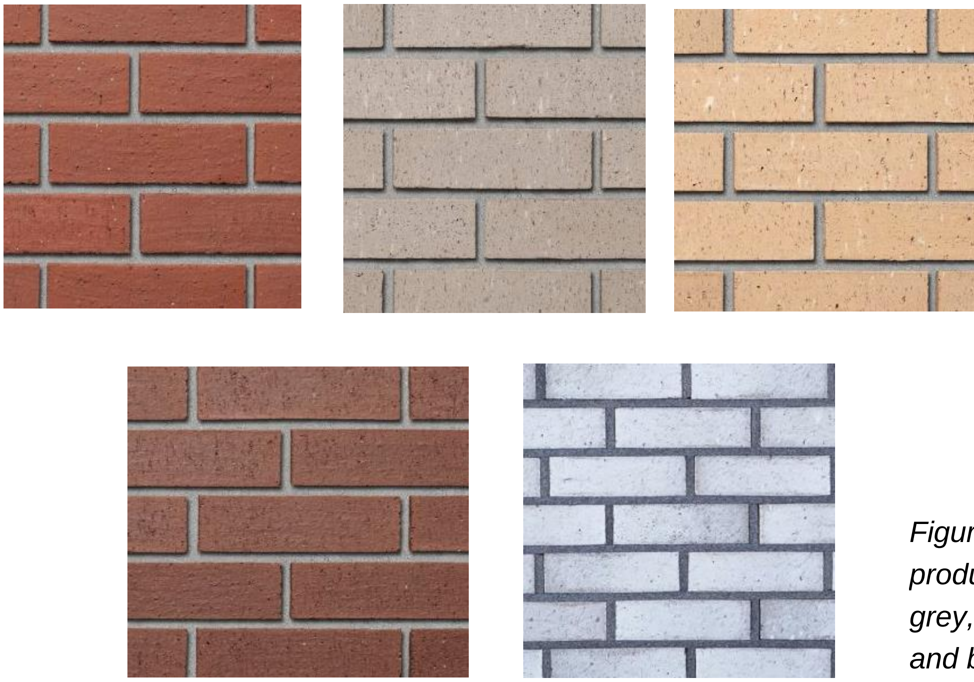

Figure 1: Clay brick products in the colours grey, red, buff, white and brown.

2.2 Technical Data

Table 2 and Table 3 provides technical data used for the Life Cycle Analysis calculations and material contents by percent breakdown.

Table 2: Technical Data used for the LCA Calculations

Property	Value	Unit
Moisture Content (raw clay delivered to brick facility)	15.70	%
Brick Density	2060	kg/m^3

Table 3: Percent breakdown of product by weight.

Material	Percent Breakdown
Raw Clay	67%
Raw Shale	32%
Barium, Manganese, Chromox, Other additives	<1%

Ancillary and packaging data was used from the U.S – Canada Industrywide Clay Brick study completed in October 7, 2020.

3. LCA Calculation Rules

3.1 Declared Unit

The declared unit is $1m^3$ of average clay brick product produced at Shaw Brick's manufacturing facility in Nova Scotia.

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 Shaw Brick's 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. Primary data on the generic raw material winning/extraction and transportation of the raw clay and shale to the manufacturing facility and primary data from the manufacturing facility were collected separately. Table 3 describes each LCI data source for raw materials (A1), transportation (A2) and the core manufacture process (A3). Table 4 also includes a data quality assessment on the basis of the technological, temporal, and geographical representativeness.

3.6 Comparability

EPDs are comparable only if they comply with this document, use the same sub-category PCR where applicable, include all relevant information modyles and are based on equivalent scenarios with respect to the context of construction works.

Table 4: Secondary data sources and data quality assessment across A1, A2, A3 for the manufacturing facility

A1: Raw Material Inputs				
Inputs	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Raw Clay/Raw Shale	Data used from analysis of the generic raw winning/extraction and transportation of raw clay and shale to manufacturing facility	Exact	2021	**Technology:** very good **Time:** very good **Geography:** very good
Barrium	Ecoinvent 3.7: Barium carbonate {GLO}| market for barium carbonate | Cut-off, U	US	2018	**Technology:** good **Time:** very good Data is <5 years old **Geography:** good Data is representative of global conditions.
Manganese	Ecoinvent 3.7: Manganese {GLO}| market for | Cut-off, U (of project Ecoinvent 3 - allocation, cut-off by classification - unit)	Global	2018	**Technology:** good **Time:** very good Data is <5 years old **Geography:** good Data is representative of global conditions.
Chromox	Ecoinvent 3.7: Chromite ore concentrate {GLO}| market for | Cut-off, U	Global	2018	**Technology:** fair **Time:** very good Data is <5 years old **Geography:** good Data is representative of global conditions.
A2: Transportation				
Inputs	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**

Trucking	USLCI: Transport, single unit truck, short-haul, diesel powered, Northwest/tkm/RNA	US	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: Electricity, low voltage {CA-NS}| market for | Cut-off, U	Global	2018	**Technology:** very good **Time:** very good Data is <5 years old **Geography:** very good
Natural Gas	USLCI: Natural gas, combusted in industrial boiler/US	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Diesel Fuel	US LCI: Diesel, combusted in industrial equipment/US	Global	2018	**Technology:** very good **Time:** very good Data is <5 years old **Geography:** good
Plastic Strapping	USLCI: Packaging film, LDPE, at plant/US- US-EI U	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Wooden Pallets	USLCI: Dry rough lumber, at kiln, US SE NREL /US Packaging	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Dividers	USLCI: Dry rough lumber, at kiln, US SE NREL /US Packaging	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very 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

Shaw Brick produces multiple products. 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.Tables 4 and 5 below summmarize the LCA results for the cradle-to-gate (A1-A3) product system. The results are calculated based on TRACI 2.1 (IPCC AR5 for GWP) per the PCR. For supplementary results according to ISO:21930 2017 see Appendix A.

Table 5: 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 6: LCA Results for 1 m^3 of Clay Brick

Environmental Indicator	Units	Total	A1	A2	A3
Environmental impact					
Global Warming Potential	kg CO_2-eq	7.21E+02	4.98E+01	1.62E+01	6.55E+02
Acidification Potential	kg SO_2-eq	6.96E+00	4.62E-01	1.70E-01	6.32E+00
Eutrophication Potential	kg PO_4-eq	1.04E+00	1.98E-01	1.01E-02	8.34E-01
Smog Potential	kg O_3-eq	4.73E+01	9.65E+00	4.27E+00	3.34E+01
Ozone Depletion Potential	kg CFC-11-eq	1.26E-05	5.79E-06	6.77E-10	6.84E-06
Total primary energy consumption					
Nonrenewable Fossil	MJ	9.67E+03	5.97E+02	2.52E+02	8.82E+03
Nonrenewable Nuclear	MJ	8.46E+01	6.37E+01	0.00E+00	2.09E+01
Renewable (Solar, Wind, Hydroelectric, and Geothermal)	MJ	3.30E+01	8.48E+00	0.00E+00	2.45E+01
Renewable (Biomass)	MJ	5.05E+01	7.89E+00	0.00E+00	4.26E+01
Material resources consumption					
Non-renewable Material Resources	kg	2.06E+03	2.06E+03	0.00E+00	0.00E+00
Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net Fresh Water (Inputs Minus Outputs)	L	6.40E+03	0.00E+00	0.00E+00	6.40E+03
Total waste generation					
Non-Hazardous Waste Generated	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Hazardous Waste Generated	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00

5. Interpretation

Figure 2 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. For all the major impact categories (GWP, ODP, AP, EP, SFP, ADPf), the biggest contributor is A3 – Manufacturing Data. The majority of emissions from A3 come from the natural gas and electricity used at the facility. There are some contributions from A1 – Raw Material Supply which are mostly from the extraction and processing of the raw clay and shale and very little emissions from A2 – Transportation.

Figure 2. Contribution analysis for Clay Brick.

6. Additonal Environmental Information

No regulated substances are contained in the declared product.

7. 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 Clay Brick Manufactured by The Shaw Group.
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.
7. NSF: 2020 - U.S. – Canada Industrywide Clay Brick Environmental Product Declaration for The Brick Industry Association
8. NSF PCR for Clay Brick, Clay Brick Pavers, and Structural Clay Tile (UNCPC 3731 and 3735) Extended 12 months per PCRExt 2022-104 - valid until June 30, 2023

Appendix A – Results per ISO 21930

Table 7: Results per ISO 21930

Environmental Indicator	Abbreviation	Units	Total	A1	A2	A3
Core Mandatory Impact Indicator						
Global warming potential	**GWP**	kg CO_2-eq	7.21E+02	4.98E+01	1.62E+01	6.55E+02
Depletion potential of the stratospheric ozone layer	**ODP**	kg CFC-11-eq	1.26E-05	5.79E-06	6.77E-10	6.84E-06
Acidification potential of land and water	**AP**	kg SO_2-eq	6.96E+00	4.62E-01	1.70E-01	6.32E+00
Eutrophication potential	**EP**	kg PO_4-eq	1.04E+00	1.98E-01	1.01E-02	8.34E-01
Formation of tropospheric ozone	**SFP**	kg O_3-eq	4.73E+01	9.65E+00	4.27E+00	3.34E+01
Abiotic depletion potential for fossil resources	**ADPf**	MJ Surplus	1.04E+04	6.66E+02	2.30E+02	9.50E+03
Fossil fuel depletion	**FFD**	MJ Surplus	1.36E+03	5.85E+01	0.00E+00	1.30E+03
Use of Primary Resources						
Renewable primary energy carrier used as energy	**RPRE**	MJ	3.83E+02	9.07E+01	0.00E+00	2.93E+02
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	1.15E+04	7.83E+02	2.44E+02	1.05E+04
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	2.93E+01	2.87E+01	0.00E+00	5.59E-01
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	9.93E-07	5.63E-07	0.00E+00	4.30E-07
Components for reuse	**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
Recovered energy exported	**EE**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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