

Ash Grove – Joliette, QC Cement Plant

An Environmental Product Declaration



About this EPD

This document is a Type III Environmental Product Declaration (EPD) describing portland cements produced by Ash Grove's Joliette, QC cement plant. The results of the underlying LCA are computed with the North American (N.A.) version of the Global Cement and Concrete Association (GCCA) Industry EPD tool for cement and concrete [1]. The GCCA tool and the underlying LCA model and database [2] have been previously verified to conform to the prevailing sub-product category rule (PCR) [3], ISO 21930:2017 (the core PCR) [4] as well as ISO 14020:2000 [5] ISO 14025:2006 [6] and ISO 14040/44:2006 LCA standards [7], [8].

This EPD is certified by ASTM to conform to the sub-Product Category Rule (PCR) referenced above, as well as to the requirements of ISO 14020, ISO 14025, ISO 21930 and ASTM International's General Program Instructions [9]. This environmental product declaration (EPD) is intended for business-to-business audiences.

General Summary

EPD Commissioner and Owner

Ash Grove, a CRH Company
Joliette Cement Plant
966 Chemin Des Prairies
Joliette, Quebec J6E 0L4
<https://www.ashgrove.com/quebec>

The Joliette cement plant provided both LCI and meta-data for limestone extraction, clinker production and cement manufacture for reference year 2020. The owner of the declaration is liable for the underlying information and evidence.

Product Group and Name

Cement, UN CPC 3744.

Product Definition

Portland cement is defined as a hydraulic cement produced by pulverizing clinker, consisting essentially of crystalline hydraulic calcium silicates, and usually containing one or more of the following: water, calcium sulfate, up to 5% limestone, and processing additions (ASTM C150, AASTHO M 85, CSA A3001).

Portland Cement *Type I (GU)* —For use when the special properties specified for any other type are not required.

Portland Cement *Type II (MS/MH)* —For general use, more especially when moderate sulfate resistance is desired.

Portland Cement *Type III (HE)* —For use when high early strength is desired.

Some cements are designated with a combined type classification, such as Type I/II, indicating that the cement meets the requirements of the indicated types and is being offered as suitable for use when either type is desired.

Blended cement is a hydraulic cement consisting of two or more inorganic constituents (at least one of which is not portland cement or portland cement clinker) which separately or in combination contribute to the strength gaining properties of the cement, (made with or without other constituents, processing additions and functional additions, by intergrinding or other blending).

- Type IL (GUL) (ASTM C595, AASHTO M 240, CSA A3001) — is a portland-limestone cement (PLC) and is a hydraulic cement in which the limestone content is more than 5% but less than or equal to 15% by mass of the blended cement.

Masonry cement is hydraulic cement manufactured for use in mortars for masonry construction or in plasters, or both, which contains a plasticizing material and, possibly, other performance-enhancing addition(s).

- Types N, S, M (ASTM C91, CSA A3002)

Product Category Rules (PCR)	NSF International, Product Category Rules for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2, September 2021 [3].
Date of Issue & Validity Period	12/09/2021 – 5 years
Declared Unit	1 metric ton of cement

EPD and Project Report Information

Program Operator	ASTM International	
Declaration Number	EPD #282	
Declaration Type	Cradle-to-gate (modules A1 to A3). Facility and product-specific.	
Applicable Countries	Canada and United States	
Product Applicability	Portland cement is the basic ingredient of concrete. Concrete, one of the most widely used construction materials in the world, is formed when portland cement creates a paste with water that binds with sand and rock to harden.	
Content of the Declaration	This declaration follows Section 9; Content of an EPD, NSF International, Product Category Rules for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2, September 2021 [3].	
This EPD was independently verified by ASTM in accordance with ISO 14025 and the reference PCR:	<p>Tim Brooke ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken PA 19428-2959, USA cert@astm.org</p>	<p>Thomas P. Gloria, Ph. D. Industrial Ecology Consultants 35 Bracebridge Rd. Newton, MA</p> <p>Internal <input type="checkbox"/> External <input checked="" type="checkbox"/></p>
Notes	The EPD results are computed using the N.A. GCCA Industry EPD tool for Cement and Concrete	
EPD Prepared by:	Athena Sustainable Materials Institute 280 Albert Street, Suite 404 Ottawa, Ontario, Canada K1P 5G8	



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In accordance with ISO 14025 and 21930



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PCR Information

Program Operator	NSF International
Reference PCR	Product Category Rules for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements, V3.1, September 2020 [3].
PCR review was conducted by:	Thomas P. Gloria, PhD (Chair), Industrial Ecology Consultants, Mr. Jack Geibig, EcoForm Mr. Bill Stough, Sustainable Research Group

Ash Grove Cement Company & Production Facility

Ash Grove Cement Company, a CRH Company, is a leader and pioneer in the cement industry. For over 139 years, we have provided Portland and masonry cements to construct the highways, bridges, commercial and industrial complexes, and single- and multi-family homes fundamental to the nation's economic vitality and quality of life. Ash Grove is one of the largest cement producers in North America with operations across Canada and the US. In Canada, Ash Grove is proud to provide cement to customers from our cement plants in Joliette, Quebec and Mississauga, Ontario. The plants are supported by a broad distribution network of 15 terminals located across Canada and the US.

Facility Name: **Joliette Cement Plant 966 Chemin Des Prairies, Joliette, QC J6E 0L4**

Product Description

This EPD reports environmental transparency information for various cements produced by Ash Grove Cement Company at its Joliette QC plant. Cements are hydraulic binders and are manufactured by grinding cement clinker and other main or minor constituents into a finely ground, usually grey colored mineral powder. When mixed with water, cement acts as a glue to bind together the sand, gravel or crushed stone to form concrete, one of the most durable, resilient and widely used construction materials in the world. The Table below sets out each cement type constituents and applicable standards. Some portland cements may have similar performance and have been aggregated here for more concise reporting purposes

Products and Standards

Inputs	Type I GU/GULA/HS	Type III GUPR/HE	Type IL GUL	Type HSF GUb-SF	Type GUb-FSF
Clinker	91%	91%	84%	80%	69%
Anhydrites	2%	2%	2%	3%	3%
Gypsum	3%	4%	8%	2%	2%
Limestone	4%	3%	11%	3%	4%
Fly Ash	0%	0%	0%	0%	15%
Silica Fume	0%	0%	0%	12%	7%



Other	<1%	<1%	<1%	<1%	<1%	Totals may not add to 100% due to rounding
Total	100%	100%	100%	100%	100%	

Applicable Standards

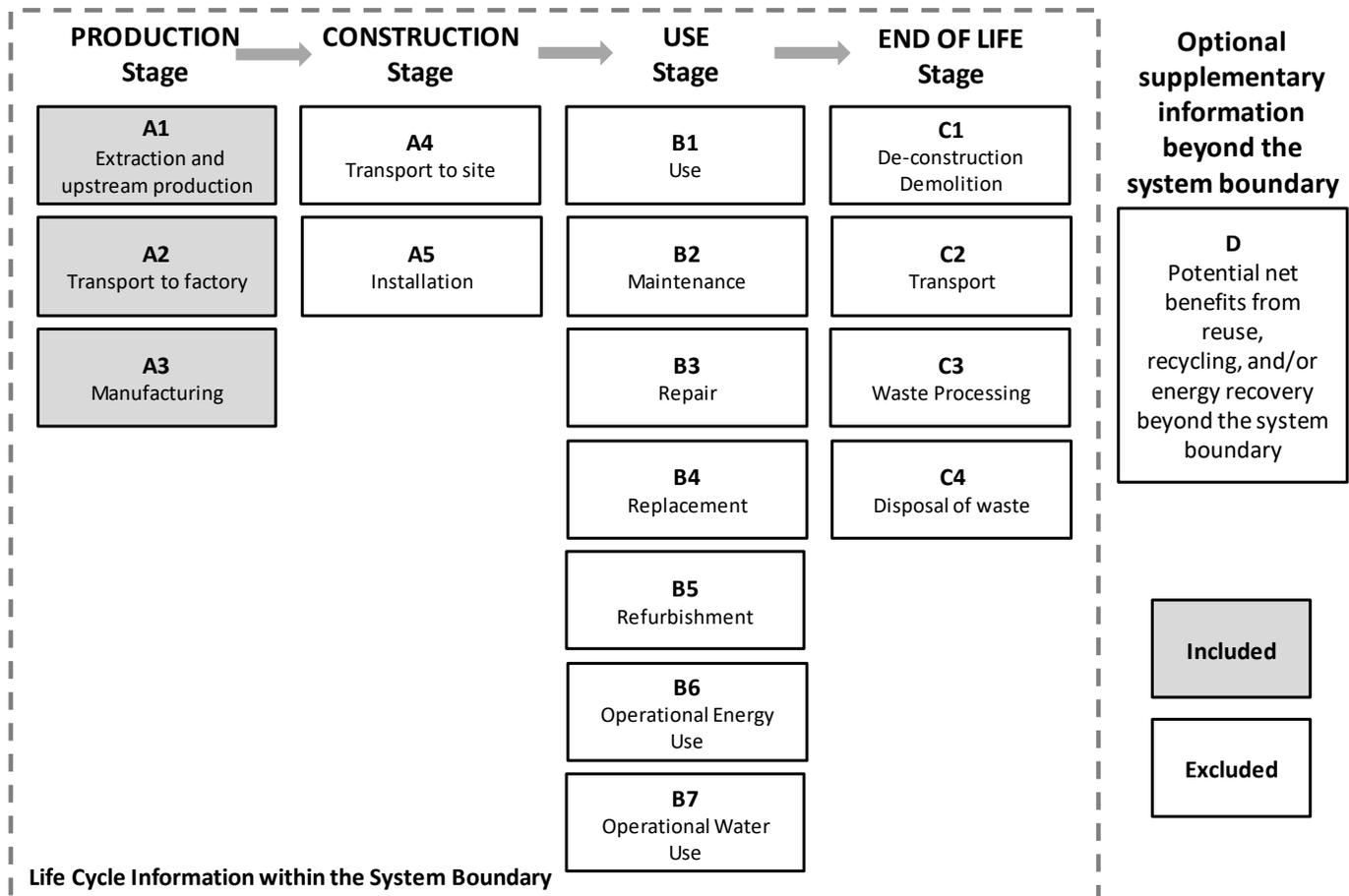
ASTM C150 / C150M, AASHTO M 85, CSA A3001 –Standard Specification for Portland Cement [10], [11] and [12].
 ASTM C595 / C595M, AASHTO M 85, CSA A3001– Standard Specification for Blended Hydraulic Cement [13], [11] and [12].
 ASTM C91, CSA A3002 – Standard Specification for Masonry Cement [14] and [15].

Declared Unit

The declared unit is one metric tonne of cement.

System Boundary

This EPD is a cradle-to-gate EPD covering the production stage (A1-A3) as depicted in the figure below. The production stage includes extraction of raw materials (cradle) through the manufacture of cements ready for shipment (gate). The Joliette cement plant sources its limestone from an adjacent quarry. The Joliette cement plant’s cement products are sold both packaged and in bulk. Packaging materials are included within the scope of this EPD.



Items *excluded* from the system boundary include:



- 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)
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location

Cut-off Criteria

The cut-off criteria as per NSF PCR, Section 7.1.8 [3] and ISO 21930, 7.1.8 [4] were followed. Per ISO 21930, 7.1.8 all input/output data required were collected and included in the LCI modelling. No substances with hazardous and toxic properties that pose a concern for human health and/or the environment were identified in the framework of this EPD. Any plant specific data gaps for the reference year 2020 e.g., amount of lubricants and refractory were filled in with industry data (secondary data).

Data Collection

Gate-to-gate input/output flow data were collected for the following processes for the reference year 2020:

- Limestone extraction, clinker production and cement manufacture – MJoliette.

Allocation Approach

Allocation of inventory flows and subsequently environmental impact is relevant when assets are shared between product systems. The allocation method prescribed by the PCR [3] is applied in the underlying LCA model. The sub-category PCR recognizes fly ash, furnace bottom ash, bypass dust, mill scale, polluted soils, spent catalyst, aluminum oxide waste, silica fume, granulated blast furnace slag, iron rich waste, cement kiln dust (CKD), flue gas desulfurization (FGD) gypsum, calcium fluoride rich waste and postconsumer gypsum as recovered materials and thus, the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a cement material input. Further, used tires, plastics, solvents, used oil and oily waste, coal/carbon waste, roofing asphalt, household refuse-derived waste, non-hazardous liquid waste, industrial sludge, and agricultural waste are considered non-renewable and/or renewable secondary fuels. Only the materials, water, energy, emissions, and other elemental flows associated with reprocessing, handling, sorting and transportation from the point of the generating industrial process to their use in the production process are considered. All emissions from combustion at the point of use are considered. For co-products, no credit is considered, and no allocation is applied. See the LCA model and LCA database reports of the N.A. version of GCCA's Industry Tool for EPDs of cement and concrete for more information [1] [2].

Data Quality Requirements and Assessment

Data Quality Requirements	Description
Technology Coverage	LCI data represents the prevailing technology in use at the Joliette facility. The Joliette plant utilizes a <i>dry kiln technology</i> . <i>Technological representativeness is characterized as "high"</i> .
Geographic Coverage	The geographic region considered is Canada and the U.S. <i>Geographical representativeness is characterized as "high"</i> .



Time Coverage	<p>Activity (primary) data are representative of 2020 calendar year (12 months).</p> <ul style="list-style-type: none"> - Joliette limestone extraction, - Joliette clinker production, - Joliette cement manufacturing, - In-bound/ out-bound transportation data - primary data collected for Joliette site. <p><i>Temporal representativeness is characterized as “high”.</i></p>
Completeness	<p>All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to complete production profile for Joliette cement products. Joliette operates a continuous emissions monitoring system and reports emissions to both the National Pollution Release Inventory. These data for 2020 were drawn on in the completion of this EPD. The completeness of the foreground process chain in terms of process steps is rigorously assessed.</p>
Consistency	<p>To ensure consistency, cross checks of the energy demand and the calculated raw meal to clinker ratio against ranges reported in the WBCSD Cement Sustainability Initiative, Cement CO₂ and Energy Protocol, v3.1 December, 2013 were conducted [16]. The LCA team conducted mass and energy balances at the facility level and selected process levels to maintain a high level of consistency.</p>
Reproducibility	<p>External reproducibility is not possible as the background report is confidential.</p>
Transparency	<p>Activity datasets are disclosed in the project LCI compilation, and the background reports generated by the GCCA Tool.</p>
Uncertainty	<p>A <i>sensitivity check</i> was conducted relative to the PCA industry average [17]. The variation for significant inputs were found to be well within the expected range and hence, there is high degree of confidence in the results.</p>

Life Cycle Impact Assessment Results: Mississauga Cement Plant

This section summarizes the production stage life cycle impact assessment (LCIA) results including resource use and waste generated metrics based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated based on 1 metric ton of each cement type as produced at the Joliette plant. *It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks [4], [8]. Further, a large number of LCA impact categories and inventory items are still emerging or under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting results for these categories – identified with an “*” [3].*

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 [3]. Environmental declarations from different programs may not be comparable [6]. EPDs are comparable only if they comply with ISO 21930, 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 [3][4].

Production stage EPD Results: Joliette Plant – per Metric Ton

Impact category and inventory indicators	Unit	Type I GU/GULA/HS	Type III GUPR/HE	Type IL GUL	Type HSF GUb-SF	Type GUb-FSF
Global warming potential, GWP 100, IPCC 2013 (AR5)	kg CO ₂ eq	986	996	910	881	753
Ozone depletion potential, ODP	kg CFC-11 eq	9.60E-06	9.89E-06	8.94E-06	1.16E-05	9.44E-06
Acidification potential, AP	kg SO ₂ eq	5.05	5.09	4.67	4.50	3.85
Eutrophication potential, EP	kg N eq	0.67	0.68	0.62	0.61	0.52
Smog formation potential, SFP	kg O ₃ eq	71.2	71.7	66.0	63.6	54.4
Abiotic depletion potential for non-fossil mineral resources, ADP elements*	kg Sb eq	1.66E-04	1.67E-04	1.52E-04	1.72E-04	1.51E-04
Abiotic depletion potential for fossil resources, ADP fossil*	MJ LHV	201	234	193	205	174
Renewable primary resources used as an energy carrier (fuel), RPR _E *	MJ LHV	815	794	693	730	662
Renewable primary resources with energy content used as material, RPR _M *	MJ LHV	19	0.85	0	7	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E *	MJ LHV	2494	2619	2321	2415	2048
Non-renewable primary resources with energy content used as material, NRPR _M *	MJ LHV	0.67	147	0	0.86	4
Secondary materials, SM*	kg	27	27	25	143	240
Renewable secondary fuels, RSF*	MJ LHV	196	0	181	173	148
Non-renewable secondary fuels, NRSF*	MJ LHV	640	640	591	563	483
Net use of freshwater, NFW*	m ³	2.04	2.12	1.81	1.86	1.65
Hazardous waste disposed, HWD*	kg	5.95E-03	5.96E-03	5.49E-03	5.24E-03	4.49E-03
Non-hazardous waste disposed, NHWD*	kg	1.04	1.04	0.96	0.92	0.79
High-level radioactive waste, conditioned, to final repository, HLRW*	kg	x ¹⁾	x ¹⁾	x ¹⁾	x ¹⁾	x ¹⁾
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW*	kg	x ¹⁾	x ¹⁾	x ¹⁾	x ¹⁾	x ¹⁾
Components for re-use, CRU*	kg	56	56	52	49	42
Materials for recycling, MFR*	kg	0.52	0.52	0.48	0.46	0.40

Materials for energy recovery, MER*	kg	0	0	0	0	0
Recovered energy exported from the product system, EE*	kg	0	0	0	0	0
Global warming potential - biogenic, GWP _{bio} *	kg CO ₂ eq	0.35	0.36	0.30	0.32	0.246
Emissions from calcination*	kg CO ₂ eq	477	477	440	420	360
Emissions from combustion of waste from renewable sources*	kg CO ₂ eq	0.07	0.07	0.07	0.06	00.05
Emissions from combustion of waste from non-renewable sources*	kg CO ₂ eq	104	104	96	92	79

¹⁾ x – Not calculated by the GCCA Tool

^{*)} Use caution when interpreting results for these categories

LCA Interpretation

The Manufacturing module (A3) drives most of the potential environmental impacts. Manufacturing energy use (electricity and thermal fuels) used during the pyroprocessing of limestone in the production of clinker is the single largest contributor to the observed environmental impacts. Clinker content in cement similarly defines the relative environmental profile of the final cement product. Raw material extraction (A1) is the second largest contributor to the Production stage EPD results, followed by transportation (A2).

Additional Environmental Information

Environmental Protection Manufacture and Equipment

Ash Grove's Joliette, QC plant is both ISO 9001 and ISO 14001 certified.

Air pollution abatement equipment used at Ash Grove Cement Company's Mississauga plant consist of high temperature baghouses, water sprinklers for dust control, and dry scrubber to control HCl emissions.

References

1. Global Cement and Concrete Association (GCCA) and Portland Cement Association (PCA), *GCCA Industry EPD Tool for Cement and Concrete (V3.0), Users Manual, North American version*, Prepared by Quantis, April 2021. <https://demo.gcca.quantis.solutions/us>
2. Global Cement and Concrete Association (GCCA) 2021. LCA Database, North American version, Prepared by Quantis, April 2021
3. NSF International, *Product Category Rule Environmental Product Declarations, PCR for Portland, Blended, Masonry, Mortar, and Plastic (Stucco) Cements, V3.2*, September 2021.
4. ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.
5. ISO 14020:2000 Environmental labels and declarations — General principles
6. ISO 14025:2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
7. ISO 14040:2006/Amd1:2020 Environmental management - Life cycle assessment - Principles and framework.
8. ISO 14044:2006/Amd1:2017/Amd2:2020 Environmental management - Life cycle assessment -Requirements and guidelines.

9. ISO 9001- Quality Management
10. ISO 14001 - Environmental Management
11. ASTM General Program Instructions. V.8.0, April 29, 2020.
12. ASTM C150 / C150M – 20 Standard Specification for Portland Cement.
13. AASHTO M 85-21 Standard Specification for Portland Cement (ASTM Designation: C150/C150M-21)
14. CSA 3001 – Cementitious Materials for Use in Concrete
15. ASTM C595 / C595M - 21 Standard Specification for Blended Hydraulic Cements
16. ASTM C91 - Standard Specification for Masonry Cement
17. CSA 3002 – Cementitious Materials for Use in Masonry and Mortar cement
18. WBCSD CSI 2013: CO₂ and Energy Protocol Version 3.1 of 9 December 2013. <https://www.cement-co2-protocol.org/en/>
19. Portland Cement Association Environmental Product Declaration – Portland Cement, ASTM International, March 12, 2021.
https://www.astm.org/CERTIFICATION/DOCS/634.EPD_for_Portland_Athena_Final_revised_04082021.pdf