Environmental Product Declaration

According to ISO 14025 and ISO 21930

An industry average cradle-to-gate EPD (also known as an "industry-wide" or "generic" cradle-to-gate EPD) for slag cement manufactured by Slag Cement Association member companies.

EPD Summary Results - One metric ton of slag cement

Category Indicator	Unit	Raw Material Supply	Transport	Manufacturing	Total
		A1	A2	A3	
Global warming potential	kg CO_2 eq.	4.6	57.0	85	146.6
Acidification potential	kg SO_2 eq.	0.2	1.2	0.7	2.1
Eutrophication potential	kg N eq.	0.01	0.05	0.21	0.27
Smog creation potential	kg O_3 eq.	0.4	20.2	5.8	26.5
Ozone depletion potential	kg CFC-11 eq.	4.21E-07	9.57E-06	6.9E-06	1.69E-05
Total primary energy consumption					
Non-renewable (fossil, nuclear)	MJ	88.9	848.4	1497.2	2,434.5
Renewable (solar, wind, biomass hydroelectric, & geothermal)	MJ	8.6	1.2	66.1	75.9
Material resources consumption					
Non-renewable materials	kg	11.0	0	0.1	11.1
Renewable materials	kg	0.5	0.1	1.9	2.5
Recovered materials	kg	1102.0	0	0	1102.0
Fresh water	l	26.1	0	5.4	31.6
Waste generated					
Non-hazardous	kg	0	0	0.3	0.3
Hazardous	kg	0	0	0.02	0.02

ASTM International Certified Environmental Product Declaration

This is an industry average business-to-business Type III environmental product declaration for slag cement as manufactured by the Slag Cement Association member companies in the USA and Canada. This declaration has been prepared in accordance with ISO 14025 [3], ISO 21930 [2], ISO 14040 [4], ISO 14044 [5] the governing slag cement category rules [1] and ASTM international's EPD program operator rules [7].

The intent of this document is to further the development of environmentally compatible and more sustainable construction products by providing comprehensive environmental information related to potential impacts of slag cement available in the USA and Canada in accordance with international standards.

Environmental Product Declaration Summary

Owner of the EPD	
	Slag Cement Association (SCA) 38800 Country Club Drive Farmington Hills, MI 48331 Phone: 847-977-6920 Link (URL): www.slagcement.org info@slagcement.org Each SCA member company provided both LCI and meta-data for the reference year 2013/14. SCA members operate more than 30 facilities in the USA and Canada including granulation, grinding and slag cement bulk distribution terminals. SCA members, with the inclusion of their Canadian holdings and affiliates, produce and ship over 95% of the slag cement consumed in the USA and Canada. The owner of the declaration is liable for the underlying information and evidence.
SCA Member Companies Corporate Locations	
	Argos USA Corporation 3015 Windward Plaza, Suite 300 Alpharetta, GA 30005 Member Link (URL): www.argos.co/usa
	Ash Grove Cement Company 11011 Cody, Suite 300 Overland Park, KS 66210

ASH GROVE	Member Link (URL): www.ashgrove.com
SCA Member Companies Corporate Locations	
Essroc Italcementi Group	**Essroc Italcementi Group** 3251 Bath Pike Nazareth, PA 18064 Member Link (URL): www.essroc.com
Holcim	**Holcim (US) Inc.** 24 Crosby Drive Bedford, MA 01730 **Holcim (Canada) Inc.** 2300 Steeles Ave. West Concord, ON L4K 5X6 Member Link (URL): www.holcim.com
LAFARGE NORTH AMERICA	**Lafarge North America Inc.** 8700 W Bryn Mawr Ave, Suite 300 Chicago, IL 60631 Member Link (URL): www.lafarge-na.com
LEHIGH HEIDELBERGCEMENT Group	**Lehigh Cement Co.** 300 E. John Carpenter Freeway Irving, TX 75062 Member Link (URL): www.lehighhanson.com
ST MARYS	**St. Marys Cement a Votorantim Cimentos Company** 55 Industrial St. Toronto, ON M4G 3W9 Member Link (URL): www.stmaryscement.com
Product Name	Slag Cement
Product Definition	Slag cement (ground granulated blast-furnace slag), UN CPC 3744, is defined as granulated blast-furnace slag that has been ground to cement fineness, with or without additions, and is a hydraulic cement [1].
Product Category Rules (PCR)	ASTM International, Product Category Rules For Preparing an Environmental Product Declaration For Slag Cement, August 2014 [1].
Certification Period	5.8.2015 - 5.8.2020
Declared Unit	1 metric ton of slag cement
ASTM Declaration Number	EPD-011

EPD Information			
Program Operator		ASTM International	
Declaration Holder		Slag Cement Association	
Product group Slag Cement	**Date of Issue** 5.8.2015	**Period of Validity** 5 years	**Declaration Number** EPD- 011
Declaration Type A "cradle-to-gate" EPD for slag cement manufactured by SCA members. Activity stages or information modules covered include production with the product ready for shipment at a distribution terminal (modules A1 to A3). The declaration is intended for use in Business-to-Business (B-to-B) communication.			
Applicable Countries United States and Canada			
Product Applicability Slag cement is a supplementary cementitious material typically used in concretes and mortars to replace a portion of the portland cement in, and augment the performance of, concrete and mortars.			
Content of the Declaration The declaration follows Section 11, Content of the EPD, ASTM International, Product Category Rules For Preparing an Environmental Product Declaration For Slag Cement, August 2014.			
This EPD was independently verified by ASTM in accordance with ISO 14025: **Internal** **External** X (External)		Timothy Brooke ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428 tbrooke@astm.org	
EPD Project Report Information			
EPD Project Report		An Industry Average Cradle-to-Gate Life Cycle Assessment of Slag Cement for the USA and Canadian Markets, March 2015	
Prepared by Athena Sustainable Materials Institute		Dr. Lindita Bushi and Jamie Meil Athena Sustainable Materials Institute 119 Ross Avenue, Suite 100 Ottawa, Ontario, K1Y 0N6, Canada lindita.bushi@athenasmi.org jamie.meil@athenasmi.org	

This EPD project report was independently verified by in accordance with ISO 14025 and the reference PCR:	Thomas P. Gloria, Ph. D. Industrial Ecology Consultants 35 Bracebridge Rd. Newton, MA 02459-1728 direct: 617.553.4929 mobile: 857.636.0585 email: t.gloria@industrial-ecology.com
PCR Information	
Program Operator	ASTM International
Reference PCR	ASTM International, Product Category Rules For Preparing an Environmental Product Declaration For Slag Cement
Date of Issue	August 2014
PCR review was conducted by:	Nicholas Santero, PE International (rebranded as thinkstep), Chair Jan Prusinski, Cement Council of Texas Anthony Fiorato, Consultant

1 PRODUCT IDENTIFICATION

1.1 PRODUCT DEFINITION

Slag cement (ground granulated blast-furnace slag), UN CPC 3744, is defined in ASTM C125 as granulated blast-furnace slag that has been ground to cement fineness, with or without additions, and that is a hydraulic cement [1]. Slag cement is a supplementary cementitious material (SCM) typically used in concretes and mortars to replace a portion of the portland cement and instill various attributes to the resulting concrete and mortar – strength, reflectance and durability. Blast furnace slag (BFS) is a waste material of pig iron production and as such is categorized as a “recovered waste material” [1], [6]. According to the slag cement PCR, recovered materials shall be considered raw materials. 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 need to be considered [1]. To transform molten BFS, with moisture content (MC) of 0% so it can be used as a SCM in concrete and mortars, it is first rapidly quenched with water to form granules known as Granulated Blast Furnace Slag (GBFS). It then undergoes dewatering/drying, iron removal from granulated slag, crushing, grinding. The ground material, slag cement (or GGBFS), is then stored onsite in a terminal or moved off-site to another distribution terminal.

SCA members shipped in the order of 3.5 million metric tons of slag cement in 2013. About 5% of the members’ 2013 slag cement shipments were direct imports from Asia. Similarly, about one third of the GBFS was also imported, primarily from Asia and Europe, for further processing at SCA member US and Canadian grinding facilities. The remaining production of slag cement (two thirds) was derived from US and Canadian GBFS sources.

Figure 1 Slag Cement (ground granulated blast furnace slag)

1.2 PRODUCT STANDARD

Applicable product standards for slag cement (UN CPC 3744) include:

- Slag cement as an SCM in concrete –
  - ASTM C989 or AASHTO M 302– Standard Specification for Slag Cement for Use in Concrete and Mortars
  - CSA A3001– Cementitious Materials for Use in Concrete
  - ASTM C125 Standard Terminology Relating to Concrete and Concrete Aggregates
- Slag Cement as a constituent of blended cement –
  - ASTM C595 or AASHTO M 240– Standard Specification for Blended Hydraulic Cements (binary or ternary blends)

2 PRODUCT APPLICATION

Slag cement is typically used in concretes and mortars to replace a portion of the portland cement in, and augment the performance of, concrete and mortars.

3 DECLARED UNIT

The declared unit is 1 metric tonne of slag cement. Data is additionally presented per short ton [1].

4 MATERIAL CONTENT

Table 1 below presents the weighted average material content by input material for the slag cement product as derived from the SCA member facilities LCI data for the timeline 2013/14. The incoming slag granules moisture content varied between 7% and 12%. Calcium sulfate additions and processing additions are permitted when tested in accordance with the requirements of ASTM C989. Gypsum and synthetic gypsum are sources of calcium sulfate. Processing additions included cement kiln dust (CKD), limestone, and organic grinding aids. Based on MSDSs provided by the facilities, a diethylene glycol based organic compound was primarily used as the grinding aid.

Table 1: Weighted Average Material Content for Slag Cement Product

Material Inputs	Amount	IP units per short ton	Amount	SI units per metric tonne	% of Total Inputs
Slag Granules	1.094	short ton	1.094	metric tonne	98.40%
Gypsum	0.007	short ton	0.007	metric tonne	0.6%
Synthetic Gypsum	0.002	short ton	0.002	metric tonne	0.1%
Cement Kiln Dust	0.005	short ton	0.005	metric tonne	0.5%
Limestone	0.004	short ton	0.004	metric tonne	0.3%
Grinding Aid	0.00017	short ton	0.00017	metric tonne	0.02%
Total	**1.112**	short ton	**1.112**	metric tonne	**100.0%**

5 PRODUCT STAGE

The product stage includes the following modules [1]:

A1 Raw material supply;
A2 Transport to the manufacturer; and
A3 Manufacturing and terminal operations.

Figure 2 shows the product stage system boundary for the declared product system.

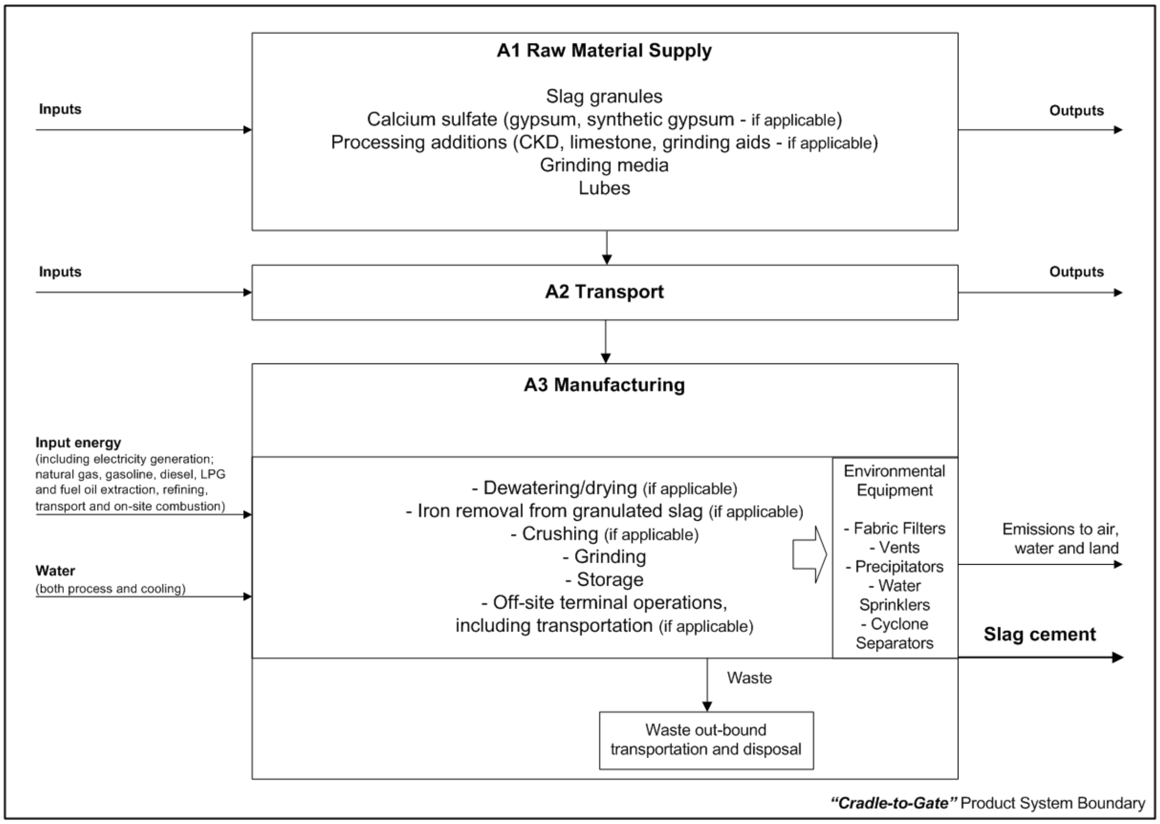

Figure 2 Product stage (module A1 to A3) system boundary

The Product Stage includes the following processes [1]:

• Extraction and processing of raw materials, including fuels used in product production;

• Average and/or specific transportation of raw materials from the extraction site or source to manufacturing site, inclusive of empty backhauls (where applicable);

• Manufacturing of slag cement;

• Bulk storage in distribution terminals inclusive of terminal operations and transportation with product ready for shipment to customers; and

• Average or specific transportation from manufacturing site to recycling/reuse/landfill for pre-consumer wastes and unutilized by-products from manufacturing, including empty backhauls.

• Final disposition of pre-consumer wastes inclusive of transportation.

As specified in slag cement PCR [1], blast furnace slag is considered a waste product (and therefore a recovered material). Recovered materials shall be considered raw materials. 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. Any allocation before reprocessing is allocated to the original product.

The Product Stage excludes the following processes [1]:

• Capital goods and infrastructure

• Personnel related activities (travel, office operations and 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.

6 LIFE CYCLE INVENTORY

6.1 DATA COLLECTION AND REPRESENTATIVENESS

Data collection was based on an initial survey of SCA member facility operations. SCA members operate more than 30 facilities in the USA and Canada comprised of granulation, grinding and standalone distribution terminal operations (note: some grinding facilities operate terminals on-site). Life cycle inventory data were collected for two operation processes – granulation (upstream process) and grinding including on-site and off-site terminal operations (core process) for the 2013/2014 calendar or fiscal year. In total 14 facilities operated by the 7 SCA company members completed LCI questionnaires representing 84% of member operated granulation facilities, 60% of grinding shipments and 76% of all shipments via off-site terminal operations. In 2013, around 18% of the total shipments were moved through off-site terminals. All LCI data were averaged on the annual production basis across facilities. The confidential LCI profile of upstream slag granules production was adjusted for country specific electricity grid and transportation mode to calculate the LCI profiles for US, Canadian, Japan, Spain and China sourced slag granules (GBFS).

6.2 CUT OFF RULES, ALLOCATION RULES AND DATA QUALITY REQUIREMENTS

Cut-off rules, as specified in ASTM PCR for slag cement: 2014, section 7.3, were applied [1]. All input/output flow data reported by the participating SCA member facilities were included in the LCI modelling. None of the reported flow data were excluded based on the cut-off criteria.

Allocation procedures observed the requirements and guidance of ISO 14040/44, clause 4.3 [4], [5] and those specified in ASTM PCR for slag cement, section 7.5 [1]. The majority of the SCA facility operations were dedicated to the production of GBFS or slag cement and hence, allocation was unnecessary. A small number of grinding facilities also produced blended cements – a co- product - and in such instances "mass" allocation was used to allocate facility LCI environmental flows (inputs and outputs) across the co-products for those facilities prior to calculating and rolling up the weighted average LCI flows for the slag cement grinding process.

In addition, the following allocation rules are applied (Section 7.5, ASTM PCR for slag cement):

- Allocation related to transport is based on the mass and distance of transported product;
- Recovered materials (raw slag, synthetic gypsum, cement kiln dust- CKD) are considered raw materials. 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. Any allocations before reprocessing shall be allocated to the original product;
- The environmental flows related to the disposal of the manufacturing (pre-consumer) solid and liquid waste are allocated to module A3 Manufacturing.

Data quality requirements, as specified in ASTM PCR for slag cement: 2014, section 7.3, were observed [1]. This section also describes the achieved data quality relative to the ISO 14040/44 requirements [4], [5]. Data quality is judged on the basis of its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

Precision: The SCA participating member companies through measurement and calculation collected primary data on their production of slag cement. For accuracy the LCA team individually validated these plant gate-to-gate input and output data.

Completeness: All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent an industry average slag cement. Primary data were also collected and validated for the granulation process and off-site terminal operations the reference year 2013/2014. The relevant background materials and processes were taken from the US LCI Database (adjusted for known data placeholders known as "dummy"[1]), ecoinvent v 3.1 LCI database for US and Canada and modeled in SimaPro software v.8.0.4, March 2015.

[1] "Dummy" is a term used by US LCI database that refers to "empty" LCI data sets (technosphere processes).

Consistency: To ensure consistency, the LCI modeling of the production weighted input and output LCI data for the slag cement used the same modeling structure across the selected SCA member facilities, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, emissions to air, water and soil, and material recycling and pre-consumer solid and liquid waste treatment. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in SCA Athena LCI database developed in SimaPro, 2015. A high level of transparency is provided throughout the report as the weighted average LCI profile is presented for the declared product. The provision of more detailed data to allow full external reproducibility was not possible due to reasons of confidentiality.

Representativeness: The representativeness of the data is summarized as follows.

- Time related coverage of the slag cement manufacturing process- primary collected data: 2013/2014 (12 months).
- Time related coverage of the “granulation” process - primary collected data: 2013/2014 (12 months).
- Generic data: the most appropriate LCI datasets were used as found in the US LCI (adjusted) Database, ecoinvent v.3.1 database for U.S, Canada and global, 2014.
- Geographical coverage: the geographical coverage is the U.S and Canada.
- Technological coverage: typical or average

7 LIFE CYCLE ASSESSMENT

7.1 RESULTS OF THE LIFE CYCLE ASSESSMENT

This section summarizes the results of the life cycle impact assessment (LCIA) based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated on the basis of one metric tonne of slag cement (Table 2), but are also provided for one short ton (2000 lbs.) of slag cement (Table 3). The slag cement production results are delineated by information module: A1 – Raw material supply, A2 – Raw material transport, and A3 Slag cement manufacturing, including terminal operations.

Table 4 provides a percent contribution summary by information module for each of the supported indicators and inventory parameters. Contribution analysis is an analytical method used to support the interpretation of LCA results and to facilitate the reader's understanding of the environmental profile of the declared product.

As per ASTM PCR for slag cement:2014, Section 8, the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD. These are relative expressions only and do not predict category impact end-points, the exceeding of thresholds, safety margins or risks. Total primary and sub-set energy consumption was compiled using a cumulative energy demand model. Material resource consumption and generated waste reflect cumulative life cycle inventory flow information. In addition, “recovered materials” indicator (including raw slag, synthetic gypsum, and CKD) is reported under “Material resources consumption”.

Table 2: LCA results- Slag cement one metric tonne - absolute basis

Category Indicator	Unit	Raw Material Supply	Transport	Manufacturing	Total
		A1	A2	A3	
Global warming potential	kg CO_2 eq.	4.6	57.0	85	146.6
Acidification potential	kg SO_2 eq.	0.2	1.2	0.7	2.1
Eutrophication potential	kg N eq.	0.01	0.05	0.21	0.27
Smog creation potential	kg O_3 eq.	0.4	20.2	5.8	26.5
Ozone depletion potential	kg CFC-11 eq.	4.21E-07	9.57E-06	6.9E-06	1.69E-05
Total primary energy consumption					
Non-renewable (fossil, nuclear)	MJ	88.9	848.4	1497.2	2,434.5
Renewable (solar, wind, biomass hydroelectric, & geothermal)	MJ	8.6	1.2	66.1	75.9
Material resources consumption					
Non-renewable materials	kg	11.0	0	0.1	11.1
Renewable materials	kg	0.5	0.1	1.9	2.5
Recovered materials	kg	1102.0	0	0	1102.0
Fresh water	l	26.1	0	5.4	31.6
Waste generated					
Non-hazardous	kg	0.14	0	0.16	0.30
Hazardous	kg	0	0	0.02	0.02

Table 3: LCA results- Slag cement one short ton - absolute basis

Category Indicator	Unit	Raw Material Supply	Transport	Manufacturing	Total
		A1	A2	A3	

Category Indicator	Unit	Raw Material Supply	Transport	Manufacturing	Total
		A1	A2	A3	
Global warming potential	kg CO_2 eq.	4.2	51.7	77.1	133.0
Acidification potential	kg SO_2 eq.	0.2	1.1	0.6	1.9
Eutrophication potential	kg N eq.	0.01	0.05	0.19	0.25
Smog creation potential	kg O_3 eq.	0.4	18.3	5.3	24.0
Ozone depletion potential	kg CFC-11 eq.	3.82E-07	8.68E-06	6.26E-06	1.53E-05
Total primary energy consumption					
Non-renewable (fossil, nuclear)	MJ	80.6	769.7	1,358.2	2,208.5
Renewable (solar, wind, biomass hydroelectric, & geothermal)	MJ	7.8	1.1	60.0	68.9
Material resources consumption					
Non-renewable materials	kg	10.0	0	0.1	10.1
Renewable materials	kg	0.5	0.1	1.76	2.3
Recovered materials	kg	999.7	0	0	999.7
Fresh water	l	23.7	0	4.9	28.7
Waste generated					
Non-hazardous	kg	0.13	0	0.15	0.28
Hazardous	kg	0	0	0.02	0.02

Table 4: LCA results- Slag cement production - percent basis

Category Indicator	Raw Material Supply	Transport	Manufacturing	Total
	A1	A2	A3	
Global warming potential	3%	39%	58%	100%
Acidification potential	12%	57%	31%	100%
Eutrophication potential	5%	19%	76%	100%
Smog creation potential	2%	76%	22%	100%
Ozone depletion potential	2%	57%	41%	100%
Total primary energy consumption				
Non-renewable (fossil, nuclear)	4%	35%	62%	100%
Renewable (solar, wind, biomass hydroelectric, & geothermal)	11%	2%	87%	100%
Material resources consumption				
Non-renewable materials	99%	0%	1%	100%
Renewable materials	20%	3%	77%	100%

Category Indicator	Raw Material Supply	Transport	Manufacturing	Total
	A1	A2	A3	
Recovered materials	100%	0%	0%	100%
Fresh water	83%	0%	17%	100%
Waste generated				
Non-hazardous	47%	0%	53%	100%
Hazardous	0%	0%	100%	100%

7.2 INTERPRETATION

As BFS is a waste product and deemed a recovered material, module A1 raw material supply is a minor contributor to the overall impact of slag cement. Across the three production information modules, module A3 slag cement manufacturing contributes the largest share of the impact category results – accounting for between 22% (smog) and 76% (eutrophication) of the impact burden. A3 is also responsible for the largest share of energy use and the largest source of greenhouse gas emissions. Raw material transportation is also significant as a considerable percentage of GBFS is sourced offshore.

8 ADDITIONAL ENVIRONMENTAL INFORMATION

Quality and Environmental Management Systems

In general, SCA member manufacturing facilities follow the ISO 14001 environmental management system, ISO 9001 quality management system or other in-house quality control systems.

Health Protection

The OSHA standards are applicable and followed.

- U.S. Department of Labor, Occupational Safety & Health Administration (OSHA),

29 CFR, PART 1910 Occupational Safety and Health Standards.

(https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910)

No additional health protection measures extending beyond mandatory occupational safety measures for commercial operations are required.

Environmental Protection Manufacture and Equipment

The SCA member manufacturing facilities comply with the regional (US and Canadian) environmental protection requirements, monitor and report the emissions to air during the manufacturing process as per the following:

- EPCRA Section 313 Toxic Release Inventory Reporting (U.S)

(http://www.ecy.wa.gov/epcra/section313.html)

- The Canadian National Pollutant Release Inventory (NPRI) reporting

(http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=4A577BB9-1)

The following process-specific emissions to air are measured at the stack after environmental control devices are utilized: particulate matter (PM)>10 microns, 2.5 microns <PM<10 microns, and PM<2.5 microns.

Environmental equipment typically used in the slag cement manufacturing facilities are as follows: fabric filter – high temperature (bag house), fabric filter- low temperature (bag house), bin vent filter, drum filter, dry filter, cartridge filter, precipitator, water sprinkler for dust control, and cyclone separators.

9 DECLARATION TYPE AND PRODUCT AVERAGE DECLARATION

The type of EPD is defined as:

A “Cradle-to-gate” EPD of slag cement covering the product stage (modules A1 to A3) and is intended for use in Business-to-Business communication.

SCA EPD of slag cement (ground granulated blast-furnace slag), UN CPC 3744 is an average product EPD, as an average from several SCA manufacturers’ facilities as listed under “SCA Member Companies Corporate Locations”, see pg. 2.

10 DECLARATION COMPARABILITY LIMITATION STATEMENT

The following ISO statement indicates the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on the ASTM’s Slag Cement PCR: 2014:

- EPDs from different programs (using different PCR) may not be comparable.

- Declarations based on the ASTM Slag Cement PCR [1] are not comparative assertions; that is, no claim of environmental superiority may be inferred or implied.

11 EPD EXPLANATORY MATERIAL

For any explanatory material, in regard to this EPD, please contact the program operator.
ASTM International

Environmental Product Declarations
100 Barr Harbor Drive,
West Conshohocken,
PA 19428-2959, http://www.astm.org

12 REFERENCES

1. ASTM International, Product Category Rules For Preparing an Environmental Product Declaration For Slag Cement, August 2014.

2. ISO 21930: 2007 Building construction – Sustainability in building construction – Environmental declaration of building products.

3. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

4. ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines.

5. ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.

6. ISO 14021:1999 Environmental labels and declarations -- Self-declared environmental claims (Type II environmental labelling)

7. ASTM Program Operator for Product Category Rules (PCRs) and Environmental Product Declarations (EPDs), General Program Instructions, October 2012.