Vulcan
Materials Company
WESTERN DIVISION

Environmental Product Declaration

This Environmental Product Declaration (EPD) is for 12 concrete aggregate products manufactured by Vulcan Materials Company at their Pleasanton, California Sand and Gravel facility.

Vulcan Materials Company, Western Division
500 North Brand Blvd.
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Glendale, CA 91203-1923

Vulcan Materials Company
Environmental Product Declaration
General Information

Environmental Product Declaration

This Environmental Product Declaration (EPD) is a non-verified environmental declaration for 12 concrete aggregate products manufactured by Vulcan Materials Company at their Pleasanton, California Sand and Gravel facility. This EPD results from a Life Cycle Assessment (LCA) conducted in accordance to the International EPD® System Construction products and Construction services product category rule (PCR).

This EPD does not conform to the ISO 14025 standard for Type III EPD's which are subject to the administration of a program operator and independent verification. Upon publication of a U.S. centric PCR, currently being developed by ASTM, Vulcan Materials Company will update this LCA to conform to the new PCR and then undergo independent verification with a program operator to publish a Type III EPD.

Product Category Rule:

International EPD® System: PCR 2012:01 Construction products and Construction services, Version 2.0, 2015-03-03.

Functional Unit:

This EPD covers only the cradle-to-gate impacts of manufactured concrete aggregate products using a declared unit of 1 metric ton.

LCA and EPD Developer:

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Products

The 12 concrete aggregates covered in this EPD are given in Table 1 and descriptions of each mix and their application are provided below. These products are compliant with the following standards and specifications:

- UN CPC 1531 – Natural sands
- UN CPC 1532 – Pebbles, gravel, broken or crushed stone
- ASTM C33 – Concrete Aggregates

Table1: Aggregates Covered in this Study

Aggregate	Abbreviation
Pleasanton 3/4" Crushed	3/4" Cr
Pleasanton 1/2" Crushed	1/2" Cr
Pleasanton 3/8" Crushed	3/8" Cr
Pleasanton Rock Dust	RD
Pleasanton Manufactured Sand	MFG Sand
Pleasanton Class II Base	C2Base
Pleasanton Class II Perm	C2Perm
Pleasanton Crushed Class II Perm	C2PermCr
Pleasanton 1" X #4	1" X #4
Pleasanton 3/4" X #4	3/4" X #4
Pleasanton 3/8" Pea Gravel	PG
Pleasanton Top Sand	WCS

Pleasanton 3/4" Crushed

A 3/4" crushed aggregate which must have 100% passing the 1" sieve and may have material retained on the 3/4" sieve. Typically an asphalt aggregate but can also be used in concrete and may be used in other applications.

Pleasanton 1/2" Crushed

A 1/2" crushed aggregate which must have 100% passing the 3/4" sieve and may have material retained on the 1/2" sieve. Typically an asphalt aggregate but can also be used in concrete and may be used in other applications.

Pleasanton 3/8" Crushed

A 3/8" crushed aggregate which must have 100% passing the 1/2" sieve and may have material retained on the 3/8" sieve. Typically an asphalt aggregate but can also be used in concrete and may be used in other applications.

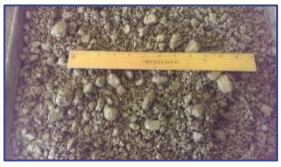
Pleasanton Rock Dust

A fine sand-like material which is a by-product of crushing aggregates. Material must have 100% passing the 3/8" sieve. Typically an asphalt aggregate but can also be used in concrete and may be used in other applications.

Pleasanton Manufactured Sand

A sand-like material that has 100% passing the 3/8″ sieve and may be produced using crushed fine materials. Typically an asphalt aggregate but can also be used in concrete and may be used in other applications.

Pleasanton Class II Base



A 3/4″ Class II aggregate base using only natural materials. Used in roadways as a base course in pavements and may be used in other applications.

Pleasanton Class II Perm

A permeable material used for drainage applications and may be used in other applications. Conforms to the specifications of Caltrans Section 68 (State of California, n.d.).

Pleasanton Crushed Class II Perm

A crushed permeable material used for drainage applications and may be used in other applications.

Pleasanton 1″ X #4

A 1″ aggregate that has 100% passing the 1 1/2″ sieve with 95-100% passing the 1″ sieve. Typically used as a concrete aggregate and may be used in other applications. Sometimes referred to as #57 aggregate.

Pleasanton 3/4″ X #4

A 3/4″ aggregate that has 100% passing the 1″ sieve with 95-100% passing the 3/4″ sieve. Typically used as a concrete aggregate and may be used in other applications. Sometimes referred to as #67 aggregate.

Pleasanton 3/8″ Pea Gravel

A 3/8″ aggregate that has 100% passing the 1/2″ sieve with 85-100% passing the 3/8″ sieve. Typically used as a concrete aggregate and may be used in other applications.

Pleasanton Top Sand

A washed sand that has 100% passing the 3/8″ sieve. Used for ready mix applications and may be used in other applications.

Material Composition

The material composition of the concrete aggregates covered in this study is listed in Table 2 below.

Table 2: Material Composition of Aggregates

Substance	Weight (%)
Natural Sand and Gravel[1]	100%

[1] Natural sand and gravel is a naturally occurring mineral complex that contains varying quantities of quartz (crystalline silica). Safety data sheet is available at: www.vulcanmaterials.com/docs/default-source/msds/3239-003-(natural-sand-and-gravel).pdf?sfvrsn=2

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Study

System boundary

This study captures the following cradle-to-gate life cycle product stages (as illustrated in Figure 1):

- A1 - Extraction and processing of raw materials as well as the fuels used in the production of aggregate and maintenance of plant equipment;
- A2 - Transportation of all input materials and fuels from the supplier to the gate of the sand and gravel plant;
- A3 – Manufacturing including mining, transportation, crushing, screening, grading, washing, blending and loading concrete aggregate as well as the transport and processing of wastes.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE			
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4

Figure 1. Life-Cycle Stages and Modules
Source: EN:15804:2012+A1, 2013)

Except as noted above, all other life cycle stages as described in Figure 1 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, delivery vehicles, and laboratory equipment;
3. Personnel-related activities (travel, furniture, office supplies);
4. Fuel used to transport personnel around the mine and sand & gravel facility;
5. Energy and water use related to company management and sales activities.

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The main processes included in the system boundary are illustrated in Figure 2.

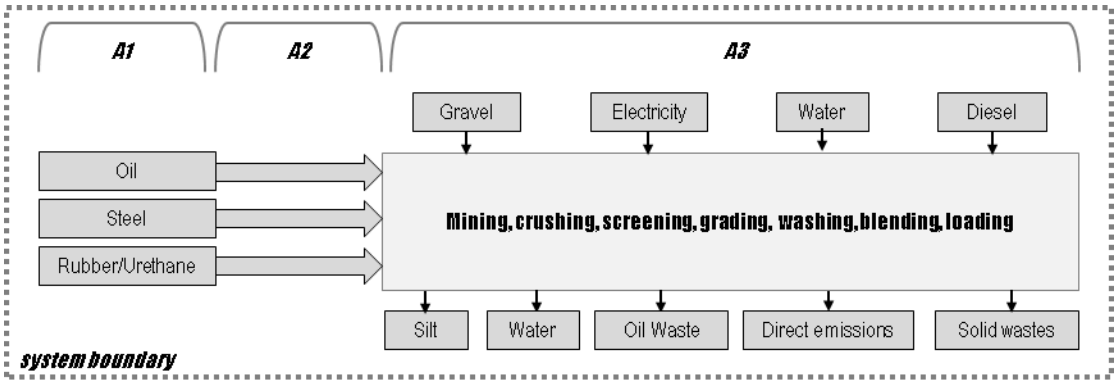

Figure 2. Main Processes Included in System Boundary

Electricity impacts are calculated based on the 2010 resource mix at the level of North American Electricity Reliability Council (NERC) Western Electricity Coordinating Council Region (EPA, 2010).[2]

Life Cycle Inventory

All primary data are average data for the 2014 calendar year.

Secondary data were selected from the US-EI database v2.2.3 (EarthShift, 2014). This database contains the US LCI database (NREL, 2008) modified to include representative proxy data in place of empty or dummy processes, and the ecoinvent v2.2 database (ecoinvent, 2010), modified to replace European electrical grids with US electrical grids.

Key Assumption

Electricity usage is based on theoretical hourly usage[3] (from engineering diagrams) converted to annual usage based on measured annual run times and an assumed load on all motors of 73%[4]. The actual load on individual motors could be higher or lower.

Environmental Impact Assessment

The environmental impact per metric ton of aggregate is reported for the life cycle impact categories outlined in the referenced PCR (International EPD® System, 2015) and provided in Table 3.

Water impacts are calculated based on net fresh water consumption as defined in Appendix D of the reference PCR (International EPD® System, 2015): "Net fresh water entering the system being studied that is not returned to the same drainage basin that it origin from, or returned to the same drainage basin with lower quality will be regarded as consumed." The water used at the Pleasanton Sand and Gravel facility is pumped from the mine, used for screening the aggregate, then sent back to settling ponds in the mine. As the water is returned to its original drainage basin it is not considered consumed.

[2] Note: this study does not conform to the referenced PCR which requires the use of national electricity grid mixes. We have use a regional grid mix in anticipation that this will be required in a US PCR.

[3] Theoretical usage was calculated by multiplying each motor's horsepower (hp) specification by 746 watts/hp.

[4] Measured 2014 electricity use allocated to the sand and gravel facility is 73% lower than theoretical.

Table 3. Category Indicators, Reported Units, Abbreviation, and Impact Assessment Method

Category Indicator	Units	Abbreviation
Global warming potential	kg CO_2 eq	GWP
Acidification potential	kg SO_2 eq	AP
Eutrophication potential	kg N eq	EP
Photochemical ozone creation potential	kg O_3 eq	POP
Ozone depletion potential	kg CFC-11 eq	ODP
Use of renewable primary energy	MJ	rPE
Use of non-renewable primary energy	MJ	nrPE
Use of renewable primary energy resources as raw materials	MJ	rPEM
Use of non-renewable primary energy resources as raw materials	MJ	nrPEM
Use of secondary materials	Kg	SM
Use of renewable secondary fuels	MJ	rSF
Use of non-renewable secondary fuels	MJ	nrSF
Use of net fresh water	m^3	nFW
Non-hazardous waste disposed	kg	nhW
Hazardous waste disposed	kg	hW
Radioactive waste disposed	kg	rW

Explanatory materials may be requested by contacting:

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Additional environmental policy and management system information is available at csr.vulcanmaterials.com.

Impact results per 1 metric ton of product are outlined in Table 3 below.

Table 4: Cradle-to-Gate Impact Results for Aggregates Covered in Study

Aggregate													
Impact category	**Unit**	**RD**	**1/2" Cr**	**3/4" Cr**	**3/8" Cr**	**MFG Sand**	**C2Base**	**C2Perm**	**C2PermCr**	**1" X #4**	**3/4" X #4**	**PG**	**WCS**
GWP	kg CO_2 eq	6.06	6.06	6.06	6.06	7.58	6.21	5.17	6.09	4.69	4.70	4.82	4.89
AP	kg SO_2 eq	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
EP	kg N eq	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
POP	kg O_3 eq	0.73	0.73	0.73	0.73	0.78	0.94	0.85	0.90	0.68	0.68	0.69	0.69
ODP	kg CFC-11 eq	1.59E-07	1.59E-07	1.59E-07	1.59E-07	2.03E-07	1.67E-07	1.36E-07	1.63E-07	1.20E-07	1.20E-07	1.24E-07	1.26E-07
rPE	MJ	7.54	7.54	7.54	7.54	10.01	6.80	5.35	6.79	5.31	5.33	5.52	5.65
nrPE	MJ	90.7	90.7	90.7	90.7	113.2	93.9	78.2	92.0	70.3	70.5	72.3	73.4
rPEM	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nrPEM	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SM	Kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
rSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nrSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
nFW	m^3	0.11	0.11	0.11	0.11	0.15	0.10	0.08	0.10	0.08	0.08	0.08	0.08
nhW	kg	0.14	0.14	0.14	0.14	0.16	0.18	0.16	0.17	0.12	0.12	0.12	0.12
hW	kg	7.84E-05	7.84E-05	7.84E-05	7.84E-05	1.02E-04	7.59E-05	6.08E-05	7.49E-05	5.70E-05	5.72E-05	5.91E-05	6.03E-05
rW	kg	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.59E-04	1.10E-04	8.69E-05	1.10E-04	8.55E-05	8.58E-05	8.88E-05	9.07E-05

[5] This EPD does not conform to the ISO 14025 standard for Type III EPD's which are subject to the administration of a program operator and independent verification. Upon publication of a U.S.-centric PCR, currently being developed by ASTM, Vulcan Materials Company will update these results to conform to the new PCR and then undergo independent verification with a program operator to publish a Type III EPD.

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This EPD only covers the cradle-to-gate life-cycle product stages. Other stages are dependent on particular scenarios that are better developed for specific building or construction works.

- EPDs of construction products may not be comparable if they do not comply with EN 15804.
- EPDs within the same product category from different programs may not be comparable.

Works Cited

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