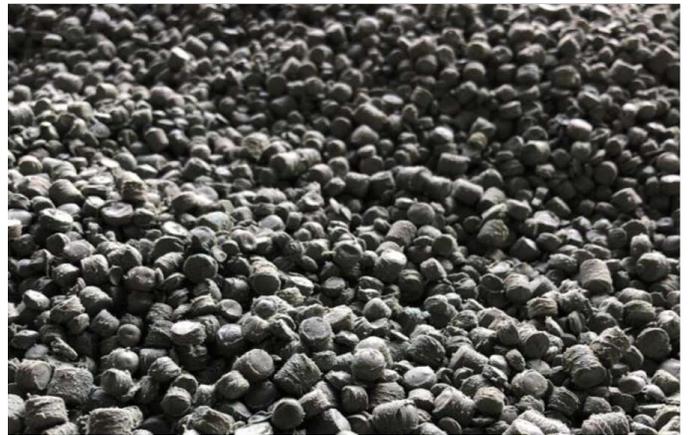




SMART GRAVEL™ Synthetic Granulate and Gravel
Manufactured in Buenos Aires, Argentina



Program Operator Information

Program Operator	NSF Certification LLC 789 N. Dixboro, Ann Arbor, MI 48105 www.nsf.org	
General Program instructions and Version Number	ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.	
Manufacturer Name and Address	Arqlite SPC 2111 S Anne St Santa Ana, CA 92704	
Declaration Number	EPD10419	
Product and Declared Unit	Two declared units are evaluated in this study; 1 kg and 1 m ³ of Smart Gravel™ Synthetic Granulate and Gravel	
Reference PCR and Version Number	ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.	
Product's intended Application and Use	Synthetic aggregate in ready mix concrete, drainage layers and vents.	
Product RSL	Not Applicable	
Markets of Applicability	Global	
Date of Issue	August 11, 2020	
Period of Validity	5 years from date of issue	
EPD Type	Product Specific	
EPD Scope	Cradle to Gate	
Year of reported manufacturer primary data	2019	
LCA Software and Version Number	GaBi 9.2.0.58	
LCI Database and Version Number	GaBi Database Version 9.2.0.58, Service Pack 40	
LCIA Methodology and Version Number	TRACI 2.1 CML 2001-Jan 2016	

<p>This declaration was independently verified in accordance with ISO 14025: 2006. ISO 21930:2017, serves as the core PCR.</p> <p><input checked="" type="checkbox"/> Internal <input type="checkbox"/> External</p>	<p>Jenny Oorbeck joorbeck@nsf.org</p> 
<p>This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:</p>	<p>WAP Sustainability Consulting</p>
<p>This life cycle assessment was independently verified in accordance with ISO 21930:2017 and ISO14025:2006 by:</p>	<p>Terrie Boguski, Harmony Environmental, LLC</p> 
<p>Limitations:</p> <p>Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Synthetic Granulate Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR.</p> <p>Full conformance with the PCR for Synthetic Granulate Products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.</p> <p>Upon written request to Arqlite, additional explanatory material can be provided to facilitate understanding of the data contained in this declaration.</p>	

Declaration of General Information

Company Description

Arqlite provides a recycling service to municipalities and private companies, differentiating from existing technologies for being capable of processing a wide variety of plastics. Through the company’s proprietary process, Arqlite uses collected waste plastic and produces a new type of plastic artificial gravel and concrete aggregate that may totally or partially replace mineral gravel or crushed rock in drainage, concrete and precast applications. Arqlite, is a Social Purpose Corporation incorporated in the State of Washington, USA.

Product Description and Intended Use

This Environmental Product Declaration (EPD) is for Arqlite’s synthetic granulate and gravel, which is designed to be used as an alternative to traditional mineral aggregates in ready-mix concrete, drainage layers, and vents. It is produced at the company’s facility in Buenos Aires, Argentina. Arqlite Gravel is lightweight, free-draining, thermal and acoustic resistive, making the product advantageous for civil engineering applications. In addition, it is made from 100% recycled plastic waste. Its use helps divert tons of these plastic materials from landfills.



Figure 1: Arqlite Recycled Plastic Gravel

Table 1: Material Composition

Raw Material	Percent of Composition	Notes
Recycled Plastic Feedstock (Post-Consumer)	100%	Comprised of an assortment of HDPE, LDPE, PET, PP, PS and other consumer plastic waste

Declaration of the Methodological Framework

Type of EPD and Declared Unit

This EPD is a Cradle-to-Gate EPD and includes the sourcing of raw materials, transportation of raw materials to the manufacturing facility, and the manufacturing and packaging of the product. These are the required modules, according to ISO 21930 (LCA modules A1-A3). In addition to the direct life cycle impacts of Arqlite products, the LCA practitioners also evaluated the potential savings associated with activities that are avoided due to the use of Arqlite’s product. This is explained in more detail in the next section.

Two declared units were evaluated in this study; 1 kg and 1 m³ of synthetic granulate. The choice to include two different declared units is related to the fact that customers typically buy the product on a mass basis but the amount of product they need for any given application is a volumetric function of the space that the product takes up as either concrete filler or drainage rock. The conversion of a mass functional unit to a volumetric declared unit is a simple function of density.

Table 2: Declared Units

	Arqlite
Declared unit [kg]	1
Declared unit [m ³]	1
Bulk Density [kg/m ³]	425
*Density sourced from Arqlite Technical Documentation.	

Relevant functional and technical characteristic are represented in the table below.

Table 3: Technical Details

Parameter	Arqlite
Inert Vegetation	Innocuous for vegetation.
Thermal conductivity	~0.5 W/(m•K)
Volume / Weight ratio	425 kg/m ³

Additional Environmental Information

Benefits Beyond System Boundary

This stage includes a life cycle-based assessment of the broader scale environmental benefit that could be realized due to the product's use (but which is not included in the direct system boundary). Because Arqlite's synthetic granulate is a product that is manufactured from 100% recycled content, it is essential to evaluate what scale of benefit (if any) comes from diverting the input raw materials from the landfill. For this assessment, the LCA practitioners calculated the savings from diverting raw materials from the landfill.

Additionally, the LCA practitioners evaluated the potential benefits associated with using Arqlite's product as a substitute for using mineral aggregate. The benefit primarily arises from mitigating mining activities that no longer need to occur. For this assessment, LCA practitioners calculated the potential benefits by averaging three common mineral fillers.

Allocation Procedure and Cut-off Procedure

General principles of allocation for the LCA were based on ISO 14040/44. There are no products other than the synthetic granulates produced as part of the manufacturing processes studied in the LCA. Since there are no co-products, no allocation based on co-products is required.

Of relevancy to the defined system boundary is the method in which recycled materials were handled. Throughout the study, recycled materials were accounted for via the cut-off method. Under this method, impacts and benefits associated with the previous life of the raw materials from recycled stock are excluded from the system boundary. Hence no impacts arise from secondary materials used as raw materials for the manufacture of synthetic gravel. The study does include the impacts associated with reprocessing and preparation of the recycled materials that are used as raw materials.

Additionally, no know flows or material inputs were deliberately excluded from the LCA.

Results - Declaration of Environmental Indicators Derived from LCA

The results presented in the following tables are for 1 kg of synthetic granulate.

Results From LCIA

Abbreviation	Parameter	Unit	Raw Material Supply (A1)	Transport (A2)	Manufacturing (A3)	Total (A1-A3)	Module D	Total
CML 2001-Jan 2016								
ADP-elements	Abiotic depletion potential for non-fossil resources	kg Sb eq	5.70E-08	9.50E-10	2.02E-08	7.81E-08	-8.22E-09	6.99E-08
ADP-fossil	Abiotic depletion potential for fossil resources	MJ, net calorific value	2.92E+00	1.86E-01	3.15E+00	6.26E+00	-1.67E+00	4.59E+00
AP	Acidification potential of soil and water	kg SO ₂ eq	1.55E-04	2.72E-05	1.75E-03	1.94E-03	-2.61E-04	1.67E-03
EP	Eutrophication potential	kg Phosphate eq	1.98E-05	7.00E-06	8.43E-05	1.11E-04	-2.06E-04	-9.46E-05
GWP	Global warming potential	kg CO ₂ eq	8.92E-02	1.34E-02	2.14E-01	3.17E-01	-1.10E-01	2.07E-01
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq	4.41E-17	6.27E-19	3.76E-17	8.23E-17	-3.08E-16	-2.26E-16
POCP	Photochemical ozone creation potential	kg Ethane eq	2.35E-05	-8.27E-06	9.87E-05	1.14E-04	-2.86E-05	8.54E-05
TRACI 2.1								
AP	Acidification potential of soil and water	kg N eq	1.72E-04	3.51E-05	1.64E-03	1.84E-03	-2.91E-04	1.56E-03
EP	Eutrophication potential	kg SO ₂ eq	9.42E-06	4.99E-06	5.32E-05	6.76E-05	-9.43E-05	-2.67E-05
GWP	Global warming potential	kg CO ₂ eq	8.92E-02	1.34E-02	2.14E-01	3.17E-01	-1.10E-01	2.07E-01
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq	4.41E-17	6.27E-19	3.76E-17	8.23E-17	-3.08E-16	-2.26E-16
Resources	Depletion of non-renewable fossil fuels	MJ, surplus energy	4.17E-01	2.65E-02	4.55E-01	8.98E-01	-2.26E-01	6.73E-01
POCP	Photochemical ozone creation potential	kg O ₃ eq	3.59E-03	7.44E-04	1.37E-02	1.80E-02	-5.68E-03	1.23E-02

Table 4: Life Cycle Impact Assessment Environmental Indicators for 1 kg of Synthetic Granulate

Results From LCI

Abbreviation	Parameter	Unit	Raw Material Supply (A1)	Transport (A2)	Manufacturing (A3)	Total (A1-A3)	Module D	Total
Resource Use Parameters								
RPR _E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)	4.94E-02	1.23E-02	7.22E-01	7.84E-01	-1.36E-01	6.48E-01
RPR _M	Use of renewable primary energy resources used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPR _E	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	2.96E+00	1.86E-01	3.42E+00	6.57E+00	-1.71E+00	4.86E+00
NRPR _M	Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary materials	kg	0.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	1.00E+00
RSF	Use of renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered energy	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Net use of fresh water	m ³	5.34E-04	1.39E-05	4.75E-03	5.30E-03	-5.40E-04	4.76E-03
Waste Parameters								
HWD	Disposed-of-hazardous waste	kg	1.03E-09	2.40E-11	1.06E-09	2.11E-09	-4.90E-09	-2.78E-09
NHWD	Disposed-of non-hazardous waste	kg	4.30E-04	1.86E-05	4.54E-04	9.02E-04	-9.96E-01	-9.95E-01
HLRW	High-level radioactive waste, conditioned, to final repository	kg	1.89E-08	1.18E-10	1.25E-07	1.44E-07	-1.78E-08	1.26E-07
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	1.57E-05	9.57E-08	1.04E-04	1.20E-04	-1.67E-05	1.03E-04
Output Flow Parameters								
CRU	Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 5: Life Cycle Inventory Indicators for 1 kg of Synthetic Granulate

Removals and Emissions from Biogenic Carbon

Parameter	Parameter	Value	Unit
BCRP	Biogenic Carbon Removal from Product	0	kg CO ₂
BCEP	Biogenic Carbon Emission from Product	0	kg CO ₂
BCRK	Biogenic Carbon Removal from Packaging	0.001	kg CO ₂
BCEK	Biogenic Carbon Emission from Packaging	0.002	kg CO ₂

Table 6: Removals and Emissions from Biogenic Carbon for 1 kg of Synthetic Granulate

Results - Declaration of Environmental Indicators Derived from LCA

The results presented in the following tables are for 1 m³ of synthetic granulate.

LCA Results From LCIA

Abbreviation	Parameter	Unit	Raw Material Supply (A1)	Transport (A2)	Manufacturing (A3)	Total (A1-A3)	Module D	Total
CML 2001-Jan 2016								
ADP-elements	Abiotic depletion potential for non-fossil resources	kg Sb eq	2.42E-05	4.04E-07	8.59E-06	3.32E-05	-5.75E-06	2.75E-05
ADP-fossil	Abiotic depletion potential for fossil resources	MJ, net calorific value	1.24E+03	7.91E+01	1.34E+03	2.66E+03	-1.17E+03	1.49E+03
AP	Acidification potential of soil and water	kg SO ₂ eq	6.59E-02	1.16E-02	7.44E-01	8.25E-01	-1.69E-01	6.52E-01
EP	Eutrophication potential	kg Phosphate eq	8.42E-03	2.98E-03	3.58E-02	4.72E-02	-9.76E-02	-5.04E-02
GWP	Global warming potential	kg CO ₂ eq	3.79E+01	5.70E+00	9.10E+01	1.35E+02	-7.67E+01	5.79E+01
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq	1.87E-14	2.66E-16	1.60E-14	3.50E-14	-1.93E-13	-1.58E-13
POCP	Photochemical ozone creation potential	kg Ethane eq	9.99E-03	-3.51E-03	4.19E-02	4.85E-02	-1.77E-02	3.08E-02
TRACI 2.1								
AP	Acidification potential of soil and water	kg N eq	7.31E-02	1.49E-02	6.97E-01	7.82E-01	-1.94E-01	5.91E-01
EP	Eutrophication potential	kg SO ₂ eq	4.00E-03	2.12E-03	2.26E-02	2.87E-02	-4.51E-02	-1.64E-02
GWP	Global warming potential	kg CO ₂ eq	3.79E+01	5.70E+00	9.10E+01	1.35E+02	-7.66E+01	5.79E+01
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq	1.87E-14	2.66E-16	1.60E-14	3.50E-14	-1.93E-13	-1.58E-13
Resources	Depletion of non-renewable fossil fuels	MJ, surplus energy	1.77E+02	1.13E+01	1.93E+02	3.82E+02	-1.60E+02	2.22E+02
POCP	Photochemical ozone creation potential	kg O ₃ eq	1.53E+00	3.16E-01	5.82E+00	7.65E+00	-4.19E+00	3.47E+00

Table 7: Life Cycle Impact Assessment Environmental Indicators for 1 m³ of Synthetic Granulate

LCA Results From LCI

Abbreviation	Parameter	Unit	Raw Material Supply (A1)	Transport (A2)	Manufacturing (A3)	Total (A1-A3)	Module D	Total
Resource Use Parameters								
RPR _E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)	2.10E+01	5.23E+00	3.07E+02	3.33E+02	- 1.01E+02	2.32E+02
RPR _M	Use of renewable primary energy resources used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPR _E	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value	1.26E+03	7.91E+01	1.45E+03	2.79E+03	- 1.19E+03	1.60E+03
NRPR _M	Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Use of secondary materials	kg	0.00E+00	0.00E+00	4.25E+02	4.25E+02	0.00E+00	4.25E+02
RSF	Use of renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered energy	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Net use of fresh water	m ³	2.27E-01	5.91E-03	2.02E+00	2.25E+00	-5.94E-01	1.66E+00
Waste Parameters								
HWD	Disposed-of-hazardous waste	kg	4.38E-07	1.02E-08	4.51E-07	8.97E-07	-2.85E-06	-1.95E-06
NHWD	Disposed-of non-hazardous waste	kg	1.83E-01	7.91E-03	1.93E-01	3.83E-01	- 4.24E+02	-4.23E+02
HLRW	High-level radioactive waste, conditioned, to final repository	kg	8.03E-06	5.02E-08	5.31E-05	6.12E-05	-1.10E-05	5.02E-05
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	6.67E-03	4.07E-05	4.42E-02	5.10E-02	-1.00E-02	4.09E-02
Output Flow Parameters								
CRU	Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8: Life Cycle Inventory Indicators for 1 m³ of Synthetic Granulate

Removals and Emissions from Biogenic Carbon

Parameter	Parameter	Value	Unit
BCRP	Biogenic Carbon Removal from Product	0	kg CO ₂
BCEP	Biogenic Carbon Emission from Product	0	kg CO ₂
BCRK	Biogenic Carbon Removal from Packaging	0.807	kg CO ₂
BCEK	Biogenic Carbon Emission from Packaging	0.935	kg CO ₂

Table 9: Removals and Emissions from Biogenic Carbon for 1 m³ of Synthetic Granulate

Declaration of Additional Environmental Information

There are no regulated substances of very high concern known to be used in the manufacturing process or within the raw materials used in the final product. Additionally, there are no known emissions of dangerous substances.

References

1. Life Cycle Assessment, LCA Report for Arqlite SPC. WAP Sustainability Consulting. June 2020.
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8. TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Version 2.1 – User Guide - <https://nepis.epa.gov/Adobe/PDF/P100HN53.pdf>.