ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Aurubis Beerse
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-AUR-20260169-CBA1-EN
Issue date	21/04/2026
Valid to	20/04/2031

Iron Silicate Koranel®

Aurubis Beerse nv

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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General Information

Aurubis Beerse nv

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-AUR-20260169-CBA1-EN

This declaration is based on the product category rules:

Lightweight aggregates / Bulk granulate, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

21/04/2026

Valid to

20/04/2031

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Dr. Martina Bender
(Managing Director Institut Bauen und Umwelt e.V.)

Iron Silicate Koranel®

Owner of the declaration

Aurubis Beerse
Nieuwe Dreef 33
2340 Beerse
Belgium

Declared product / declared unit

1 ton iron silicate

Scope:

Iron-silicate aggregates up to a grain size of 0-4 mm from the production at Aurubis Beerse, Belgium.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Manfred Russ,
(Independent verifier)

Product

Product description/Product definition

Koranel® represents an engineered mineral comparable to natural minerals from quarries but already produced and available.

Iron silicate is co-produced during pyrometallurgical smelting and refining of copper from secondary raw materials, by reduction at high temperature in molten state in a furnace. The iron silicate is further treated in a fuming furnace prior to granulation in water.

It mainly contains iron silicate and silicates of aluminum and calcium. Traces of other non-ferrous metals are reduced to the lowest extent economically and technologically viable, and are largely included in the silicate phases. Its physical and chemical characteristics remain consistent over time.
Koranel® represents black granules with particle size 0-4 mm. The granulation process is specifically controlled to achieve a granulated physical form and glassy structural properties.

Strong mechanical properties (e.g., volume stability, strength, hardness, frost resistance) make it useful for construction applications. For the placing of the product on the market in the European Union/European Free Trade Association /EU/EFTA) (with the exception of Switzerland) the *Regulation (EU) No. 305/2011 (CPR)* applies. The product has a declaration of performance taking into consideration:

- *EN 12620:2002+A1:2008, Aggregates for concrete*, and
- *EN 13242: Aggregates for unbound and hydraulically bound materials*.

The relevant national regulations apply to both standards.

Application

Koranel® is used as aggregate for the production of concrete and stabilized sand: sand cement and concrete for prefabricated products. It is also used for the production of blended cements and cement replacement in concrete applications. It also can be used for other applications such as sub-base layer in road construction, abrasive blasting and iron corrector in clinker production.

Technical Data

The technical specification and parameters declared within the CE mark of iron silicate in the declarations of performance related to *EN 12620:2002+A1:2008, Aggregates for concrete* and *EN 13242: Aggregates for unbound and hydraulically bound materials* are given in the table below.

Constructional data

Name	Value	Unit
Bulk density EN 12620, EN 13242	2.10	Mg/m³
Real volumetric mass EN 12620, EN 13242	3.45	Mg/m³
Absolute volumetric mass EN 12620, EN 13242	3.54	Mg/m³
Content of fine particles EN 12620, EN 13242	f3	category
Grain size distribution EN 12620	GF85	category
Grain size distribution EN 13242	GTF25	category
Methylene blue test EN 12620, EN 13242	MB=0.2	category
Chloride content EN 12620	0.001	%
Acid soluble sulfates EN 12620, EN 13242	AS0.2	category
Total sulfur content EN 12620	0.1	%
Total sulfur content EN 13242	S1	category
Water absorption EN 12620	0.1	%
Water absorption EN 13242	WA 24 1	category
Organic Impurities /Humus content EN 12620, EN 13242	negative	%
Determination of slag expansion EN 12620	0	%
Determination of free CaO EN 12620	0.1	%
Volumetric stability: drying shrinkage EN 12620	0.3	%
Hardness (Mohs)	7	category

Performance data of the product with respect to its characteristics are in accordance with the relevant national technical provisions (no CE-marking) at the location the use.

Base materials/Ancillary materials

Name	Value	Unit
Iron silicate, copper smelting and -refining, associated EC number: 701-480-0	100	%

The product contains substances from the *ECHA Candidate List* of Substances of Very High Concern for authorization (27.06.2024) above 0.1 mass %: No

Reference service life

The service life of iron silicate depends on the intended use. As an aggregate in concrete and cement production, a reference service life of ≥ 50 years can be expected according *BBSR tables - Service Life of Building Components*.

LCA: Calculation rules

Declared Unit

The declared unit is 1 ton of iron silicate. A conversion into m³ can be made using the specified raw or bulk density.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	t
Bulk density	2100	kg/m^3
Real volumetric mass	3450	kg/m^3

The value given as bulk density is an average value that may be subject to slight fluctuations depending on the grain size. The LCA results are based on an average value of iron silicate of different grain sizes. The mean value was calculated for all grain sizes produced by the manufacturer. The results are therefore subject to a certain degree of variability, as production data may differ slightly depending on the grain size produced.

System boundary

Type of EPD: cradle to gate + modules C1-C4 and module D (A1-A3, C, D).

Module A1 to A3:

The production stage A1-A3 includes the processing of iron silicate, a by-product of copper production at Aurubis. Burdens for the provision of raw materials are allocated 100% to copper production.
These modules consider the demands for auxiliaries and energy for operating the production sites. The processed iron silicate is sold as bulk material without packaging.

Module C1 to C4:
Whether and in what form dismantling takes place depends on the application of the iron silicate. For Module C1, dismantling with a diesel-powered excavator is assumed.
Module C2 takes into account truck transport (diesel, Euro 6) over 50 km to a waste treatment site.
Two scenarios are declared for waste treatment:

1. 100 % recovery (C3; C4): Representative burdens for construction waste processing; crushing of the iron silicate and its use as bulk granulate or gravel (recovery includes 3% losses in waste processing).
2. 100 % landfill (C3/1; C4/1): Landfilling of the iron silicate.

Module D:
As the unprocessed iron silicate enters the system burden-free as a by-product of copper production, no recycling potentials are associated with Module D. This approach follows the specifications from the *PCR Part A, chapter 6.5.6*.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Belgium

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. All background data was taken from the *Sphera MLC databases*, version CUP 2025.1. The LCIA-results were calculated using the LCA software *LCA FE from Sphera*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The product contains no biogenic carbon. As the product is delivered without packaging, no biogenic carbon is to be declared for packaging.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	-	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Information on the electricity mix used in module A3:
Global Warming Potential (GWP-total acc. EN15804, EF3.1) of electricity mix: 0.15 kg CO2 eq/kWh

End of life (C1 - C4)
Two scenarios are declared for waste treatment:

1. 100% recovery (C3; C4): Representative burdens for construction waste processing; 3% losses are included in the used LCI-dataset.
2. 100 % landfill (C3/1; C4/1): Landfilling of the iron silicate.

Name	Value	Unit
Collected separately waste type construction waste	1000	kg
Collected as mixed construction waste	-	kg
Reuse	-	kg
Recycling (C3)	1000	kg
Recovered material from recycling (C3; D)	970	kg
Energy recovery	-	kg
Landfilling (C4/1)	1000	kg

LCA: Results

The following information on the environmental impacts was determined using the characterisation factors according to EF 3.1, which correspond to EN 15804+A2.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 ton Iron Silicate

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C4	C4/1	D	D/1
GWP-total	kg CO_2 eq	6.67E-01	6.5E-01	4.16E+00	2.77E+00	0	0	1.53E+01	0	0
GWP-fossil	kg CO_2 eq	6.63E-01	6.41E-01	4.11E+00	2.74E+00	0	0	1.53E+01	0	0
GWP-biogenic	kg CO_2 eq	4.5E-03	2.04E-03	7.71E-03	1.38E-03	0	0	0	0	0
GWP-luluc	kg CO_2 eq	1.62E-04	6.65E-03	4.34E-02	2.36E-02	0	0	6.27E-02	0	0
ODP	kg CFC11 eq	2.65E-13	1.07E-13	6.99E-13	5.39E-12	0	0	4.26E-11	0	0
AP	mol H^+ eq	4.94E-04	3.26E-03	5.35E-03	1.39E-02	0	0	1.08E-01	0	0
EP-freshwater	kg P eq	3.51E-06	1.74E-06	1.14E-05	6.87E-06	0	0	2.27E-05	0	0
EP-marine	kg N eq	2.19E-04	1.59E-03	1.96E-03	6.47E-03	0	0	2.83E-02	0	0
EP-terrestrial	mol N eq	2.13E-03	1.72E-02	2.06E-02	7.01E-02	0	0	3.08E-01	0	0
POCP	kg NMVOC eq	5.85E-04	4.3E-03	4.61E-03	1.72E-02	0	0	8.46E-02	0	0
ADPE	kg Sb eq	1.03E-08	4.3E-08	2.8E-07	2.79E-06	0	0	9.46E-07	0	0
ADPF	MJ	3.78E+01	8.28E+00	5.4E+01	5.07E+01	0	0	2.01E+02	0	0
WDP	m^3 world eq deprived	8.09E+00	2.96E-03	1.93E-02	4.88E-01	0	0	1.65E+00	0	0

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 ton Iron Silicate

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C4	C4/1	D	D/1
PERE	MJ	1.69E-01	6.24E-01	4.07E+00	4.97E+00	0	0	3.87E+01	0	0
PERM	MJ	0	0	0	0	0	0	0	0	0
PERT	MJ	1.69E-01	6.24E-01	4.07E+00	4.97E+00	0	0	3.87E+01	0	0
PENRE	MJ	3.78E+01	8.28E+00	5.4E+01	5.07E+01	0	0	2.01E+02	0	0
PENRM	MJ	0	0	0	0	0	0	0	0	0
PENRT	MJ	3.78E+01	8.28E+00	5.4E+01	5.07E+01	0	0	2.01E+02	0	0
SM	kg	0	0	0	0	0	0	0	9.7E+02	0
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	3.02E-01	3.09E-04	2.01E-03	1.33E-02	0	0	4.84E-02	0	0

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 ton Iron Silicate

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C4	C4/1	D	D/1
HWD	kg	3.62E-10	3.32E-10	2.17E-09	6.99E-09	0	0	4.39E-08	0	0
NHWD	kg	9.08E-02	1.16E-03	7.54E-03	1.28E-02	0	0	1E+03	0	0
RWD	kg	9.47E-03	1.56E-05	1.02E-04	6.43E-04	0	0	2.13E-03	0	0
CRU	kg	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	1E+03	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 ton Iron Silicate

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C4	C4/1	D	D/1
PM	Disease incidence	4.47E-09	3.84E-08	5.18E-08	2.66E-07	0	0	1.35E-06	0	0
IR	kBq U235 eq	6.61E-01	2.24E-03	1.46E-02	1.02E-01	0	0	2.36E-01	0	0
ETP-fw	CTUe	1.76E+00	1.08E+01	7.02E+01	5.06E+01	0	0	1.55E+02	0	0
HTP-c	CTUh	1.07E-10	1.45E-10	9.47E-10	8.07E-10	0	0	2.67E-09	0	0
HTP-nc	CTUh	1.42E-09	8.13E-09	5.29E-08	3.35E-08	0	0	9.98E-08	0	0
SQP	SQP	8.62E-02	3.66E+00	2.39E+01	1.43E+01	0	0	4.95E+01	0	0

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

References

Standards

EN 12620
EN 12620:2008-07, Aggregates for concrete.

EN 13043
EN 13043:2002-12, Aggregates for bituminous mixtures and surface treatments for roads, airfields, and other trafficked areas.

EN 13242
EN 13242:2008-03, Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction.

EN 15804
EN 15804:2012 + A2:2019 + AC:2021, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

ISO 14025
EN ISO 14025:2011, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

Regulation (EU) No 305/2011 (CPR)
Regulation (EU) No 305/2011 (Construction Products Regulation, CPR) – Laying down harmonised conditions for the marketing of construction products, European Commission, 2011.

Additional References

BBSR tables - Service Life of building components
BBSR tables - Service Life of building components: Nutzungsdauern von Bauteilen zur Lebenszyklusanalyse nach BNB, Bundesinstitut für Bau-, Stadt- und Raumforschung, Referat II Nachhaltiges Bauen; available online at: https://www.nachhaltigesbauen.de/austausch/nutzungsdauern-von-bauteilen/, 2025.

ECHA Candidate List
ECHA List of Substances of Very High Concern (SVHC) for Authorisation, European Chemicals Agency (ECHA), 2024.

PCR – Part A
PCR Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN15804+A2:2019, version 1.4, Institut Bauen und Umwelt e.V., https://ibu-epd.com/, 2024.

PCR – Part B
PCR – Part B: Requirements of the EPD for Lightweight aggregates / Bulk granulate, version v8, 04/07/2023 (template v11, 01/08/2024), Institut Bauen und Umwelt e.V., https://ibu-epd.com/, 2024.

Sphera
Sphera's Software System LCA for Experts (LCA FE) and MLC databases (formerly GaBi), University of Stuttgart (LBP) and Sphera, Leinfelden-Echterdingen; dataset documentation available online at: https://lcadatabase.sphera.com/.

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