**Environmental Product Declaration (EPD)**
According to ISO 14025 and EN 15804

# Natural aggregates






| | |
|---|---|
| Registration number: | EPD-Kiwa-EE-165629-EN |
| Issue date: | 02-02-2024 |
| Valid until: | 02-02-2029 |
| Declaration owner: | Rheinische Baustoffwerke GmbH |
| Publisher: | Kiwa-Ecobility Experts |
| Program operator: | Kiwa-Ecobility Experts |
| Status: | verified |

# 1 General information

## 1.1 PRODUCT

Natural aggregates

## 1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-165629-EN

## 1.3 VALIDITY

**Issue date:** 02-02-2024

**Valid until:** 02-02-2029

## 1.4 PROGRAM OPERATOR

Kiwa-Ecobility Experts
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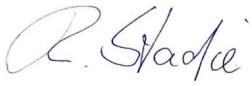
DE

Raoul Mancke

*(Head of programme operations, Kiwa-Ecobility Experts)*



Dr. Ronny Stadie

*(Verification body, Kiwa-Ecobility Experts)*

## 1.5 OWNER OF THE DECLARATION

**Manufacturer:** Rheinische Baustoffwerke GmbH

**Address:** In der Laag 83, 41517 Grevenbroich-Frimmersdorf

**E-mail:** info@rheinischebaustoffwerke.de

**Website:** https://www.rheinischebaustoffwerke.de/

**Production location:** Rheinische Baustoffwerke average location - all locations are listed in—2.1

**Address production location:** average location, all locations are listed in 2.1

## 1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in—compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804:2012+A2:2019 serves asthe core PCR.

☐ Internal ☒ External

Lucas Pedro Berman, Senda

## 1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The programme operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

## 1.8 PRODUCT CATEGORY RULES

Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules (2022-02-14)

Institute Construction and Environment e.V. (IBU) - Part B: Requirements on the EPD for Natural aggregates (2023-07-04)

## 1.9 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804. For the

# 1 General information

evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

## 1.10 CALCULATION BASIS

**LCA method R<THiNK:** Ecobility Experts | EN15804+A2

**LCA software*:** Simapro 9.1

**Characterization method:** EN 15804 +A2 Method v1.0

**LCA database profiles:** EcoInvent version 3.6

**Version database:** v3.15 (2023-07-12)

** Used for calculating the characterized results of the Environmental profiles within R<THiNK.*

## 1.11 LCA BACKGROUND REPORT

This EPD is generated on the basis of the LCA background report 'Natural aggregates ' with the calculation identifier ReTHiNK-65629.

# 2 Product

## 2.1 PRODUCT DESCRIPTION

The EPD is an average EPD that contains the data for aggregates of four different sizes from nine different locations.

The four products are as follows:

-fine aggregate sand with a grain size of between 0/2
-coarse aggregate gravel with a grain size of between 2/8
-coarse aggregate gravel with a grain size of between 8/16
-coarse aggregate gravel with a grain size of between 16/32

The nine production locations are as follows:

-Blatzheim, Am Kieswerk 1, 50171 Kerpen, DE
-Alt-Lich, Licher Straße, 52382 Niederzier, DE
-Buir, Buirer Heide, 50170 Kerpen-Buir, DE
-Dorsfeld, Dorsfeld, 50171 Kerpen, DE
-Erkelenz, Hauerwerg (An der L19), 41812 Erkelenz-Kückhoven, DE
-Garzweiler, Am Pösenberg, 41517 Grevenbroich, DE
-Gymnich, Kerpener Straße, 50374 Erfstadt-Gymnich, DE
-Kaarst, Niederdonker Straße, 41564 Kaarst, DE
-Straßfeld, An der Steinrutsche, 53913 Swisttal-Straßfeld, DE

## 2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

Aggregates can be used in a wide array of construction processes and materials. They are one of the primary components in the production of concrete and asphalt, but also serve as load bearing materials and filling materials in road and railway construction, or in the filtration of water.

The products in question have been quality assured in accordance with the following certifications:

-DIN EN 12620:2008-07 Aggregates for concrete
-DIN EN 13139:2013-07 Aggregates for mortar
-DIN EN 13043:2002-12 Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas

## 2.3 REFERENCE SERVICE LIFE

**RSL PRODUCT**

As aggregates are semi-finished products, no reference service life (RSL) is declared. A RSL could be declared for downstream products, e.g. ready-mixed concrete, precast concrete, screed, plaster, mortar or other construction products in which cement and/or building lime are used. As in input is required, “50” was used, as that represents the RSL for most of the products in which natural aggregates are being used. This has no impact on the calculations presented.

**USED RSL (YR) IN THIS LCA CALCULATION:**

50

## 2.4 SUBSTANCES OF VERY HIGH CONCERN

No dangerous substances from the candidate list of SVHC for Authorisation are used in the product. There is no data regarding radioactivity of the material.

## 2.5 DESCRIPTION PRODUCTION PROCESS

As this EPD contains the data for nine different locations it is important to note that the production process is the same for eight of these locations, which are dry excavation sites. The location Kaarst uses wet excavation. As the only slightly discernable difference between the wet and dry excavation is the water usage, while Diesel and electricity consumption remained even in relation to the product handled, the site can be included in the average.

Firstly, the soil must be removed to gain initial access to the sand and gravel in a preliminary process. This is done by an external contractor and is called overburdening. In all 9 sites this process is being carried out by excavators. The material excavated in this process is used either for landscaping processes or stored for recultivation.
Following this, the gravel and sand are extracted with the use of excavators and wheel loaders, or a dredger in Kaarst. In the 8 dry excavation sites the material is then fed into a feeding hopper, which places the material on an array of conveyor belts. The conveyor bands transport the raw material into processing plants, which washes, sifts and sorts the material into the different desired grain sizes. The products are then stored and loaded onto the lorries used for transportation to the customer.
In Kaarst the raw material is roughly sorted in a feed hopper and then transported on conveyor belts to multiple different processing plants that each sift out specific grain sizes. The finely grained products are dewatered using a dewatering screw.

# 3 Calculation rules

## 3.1 DECLARED UNIT

reference_unit: ton (ton)

## 3.2 CONVERSION FACTORS

| Description | Value | Unit |
|---|---|---|
| reference_unit | 1 | ton |
| weight_per_reference_unit | 1000.000 | kg |
| Conversion factor to 1 kg | 0.001000 | ton |

## 3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to gate LCA. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | X | X | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

The modules of the EN15804 contain the following:

| | |
|---|---|
| Module A1 = Raw material supply | Module B5 = Refurbishment |
| Module A2 = Transport | Module B6 = Operational energy use |
| Module A3 = Manufacturing | Module B7 = Operational water use |
| Module A4 = Transport | Module C1 = De-construction / Demolition |
| Module A5 = Construction - Installation process | Module C2 = Transport |
| Module B1 = Use | Module C3 = Waste Processing |
| Module B2 = Maintenance | Module C4 = Disposal |
| Module B3 = Repair | Module D = Benefits and loads beyond the product system boundaries |
| Module B4 = Replacement | |

## 3.4 REPRESENTATIVENESS

The input data is representative for Natural aggregates , a product of Rheinische Baustoffwerke GmbH. The data is representative for the companies products in the geographic location of Germany. The specific plants from which data is included in this EPD are listed in 2.1.

## 3.5 CUT-OFF CRITERIA

**Product Stage (A1-A3)**

All input flows (e.g. raw materials, transportation, energy use, etc.) and output flows (e.g. production waste) have been collected. All processes and materials that contribute to more than 1% of the entire mass, energy use or environmental impacts of the system, have been included. The total neglected input flows do not exceed the limit of 5% of energy use and mass.
More specifically for this calculation, the manufacturing process of the equipment, buildings and any other capital goods used in the natural aggregate production have not been included. Also not considered was the transportation of personnel to the plant, within the plant, research and development activities and long-term emissions. Exipients and fluctuants have also been excluded.

## 3.6 ALLOCATION

As the process of creating aggregates creates a co-product, allocation has been applied. The co-product is a sand with a special, finer grain size of between 0/1. As the average price of the aggregates included in the EPD is almost twice as high per ton the average price of the co-product, the allocation type is economical.

The data was calculated according to the annual quantity by economic impact. The raw materials and energy were calculated according to this allocation key.

# 3 Calculation rules

| Allocation | | | | |
|---|---|---|---|---|
| | | | Allocation factor | 0,351088647 |
| | Unit | Overall usage | usage co-product | usage product |
| Water | kg | 487,238 | 171,064 | 316,174 |
| Electricity | kWh | 2,158 | 0,758 | 1,400 |
| Diesel | l | 0,163 | 0,057 | 0,106 |
| Raw Material | kg | 1000 | 351,088647 | 648,911353 |

## 3.7 DATA COLLECTION & REFERENCE TIME PERIOD

Primary data was collected and provided by Rheinische Baustoffwerke internally. The data refers to the calendar year 2022 for eight of the locations.

As the location Alt-Lich only opened in late 2022, data from the 2023 was used until and including November. The last month of December 2023 was extrapolated on the basis of the preceding months.

## 3.8 ESTIMATES AND ASSUMPTIONS

The total production numbers for the location Alt-Lich for the year 2023 include one month of extrapolated data.

The EPD contains the data for four different products in nine different locations, that were all supposed to be covered using one EPD creating an average from the data for all of the locations. To increase accuracy, a weighted average of the resource usage has been created based on the raw material usage in each location.

## 3.9 DATA QUALITY

The used data stems from the internal controlling of the yearly production amounts and resources used to be able to produce. The data is, therefore, comprised of primary data directly collected by Rheinische Baustoffwerke. Overall, the data quality can be described as good.

While the data quality is good, the usage of an average between 9 locations with different weightings have to be considered.

## 3.10 GUARANTEES OF ORIGIN

As each location only uses the standard electricity mix of Germany, no guarantees of origin have to be provided. The location-based method has been used.

# 4 Results

For the impact assessment, the characterization factors of the LCIA method EN 15804 +A2 Method v1.0 are used. Long-term emissions (>100 years) are not considered in the impact assessment. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

## 4.1 ENVIRONMENTAL IMPACT INDICATORS PER TON

### CORE ENVIRONMENTAL IMPACT INDICATORS EN15804+A2

| Abbreviation | Unit | A1 | A2 | A3 |
|---|---|---|---|---|
| AP | mol H+ eqv. | 0.00E+0 | 3.91E-3 | 5.06E-2 |
| GWP-total | kg CO2 eqv. | 0.00E+0 | 6.75E-1 | 8.48E+0 |
| GWP-b | kg CO2 eqv. | 0.00E+0 | 3.12E-4 | 6.66E-2 |
| GWP-f | kg CO2 eqv. | 0.00E+0 | 6.75E-1 | 8.41E+0 |
| GWP-luluc | kg CO2 eqv. | 0.00E+0 | 2.47E-4 | 6.27E-4 |
| EP-m | kg N eqv. | 0.00E+0 | 1.38E-3 | 2.05E-2 |
| EP-fw | kg P eqv. | 0.00E+0 | 6.81E-6 | 1.41E-4 |
| EP-T | mol N eqv. | 0.00E+0 | 1.52E-2 | 2.27E-1 |
| ODP | kg CFC 11 eqv. | 0.00E+0 | 1.49E-7 | 1.98E-6 |
| POCP | kg NMVOC eqv. | 0.00E+0 | 4.34E-3 | 6.27E-2 |
| ADP-f | MJ | 0.00E+0 | 1.02E+1 | 1.30E+2 |
| ADP-mm | kg Sb-eqv. | 0.00E+0 | 1.71E-5 | 2.01E-4 |
| WDP | m3 world eqv. | 0.00E+0 | 3.64E-2 | -4.52E+1 |

**AP**=Acidification (AP) | **GWP-total**=Global warming potential (GWP-total) | **GWP-b**=Global warming potential - Biogenic (GWP-b) | **GWP-f**=Global warming potential - Fossil (GWP-f) | **GWP-luluc**=Global warming potential - Land use and land use change (GWP-luluc) | **EP-m**=Eutrophication marine (EP-m) | **EP-fw**=Eutrophication, freshwater (EP-fw) | **EP-T**=Eutrophication, terrestrial (EP-T) | **ODP**=Ozone depletion (ODP) | **POCP**=Photochemical ozone formation - human health (POCP) | **ADP-f**=Resource use, fossils (ADP-f) | **ADP-mm**=Resource use, minerals and metals (ADP-mm) | **WDP**=Water use (WDP)

# 4 Results

### ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN15084+A2

| Abbreviation | Unit | A1 | A2 | A3 |
|---|---|---|---|---|
| ETP-fw | CTUe | 0.00E+0 | 9.07E+0 | 8.55E+1 |
| PM | disease incidence | 0.00E+0 | 6.07E-8 | 9.49E-7 |
| HTP-c | CTUh | 0.00E+0 | 2.94E-10 | 3.52E-9 |
| HTP-nc | CTUh | 0.00E+0 | 9.93E-9 | 9.42E-8 |
| IR | kBq U235 eqv. | 0.00E+0 | 4.26E-2 | 5.14E-1 |
| SQP | Pt | 0.00E+0 | 8.83E+0 | 1.07E+2 |

**ETP-fw**=Ecotoxicity, freshwater (ETP-fw) | **PM**=Particulate Matter (PM) | **HTP-c**=Human toxicity, cancer (HTP-c) | **HTP-nc**=Human toxicity, non-cancer (HTP-nc) | **IR**=Ionising radiation, human health (IR) | **SQP**=Land use (SQP)

### CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

| ILCD classification | Indicator | Disclaimer |
|---|---|---|
| ILCD type / level 1 | Global warming potential (GWP) | None |
| | Depletion potential of the stratospheric ozone layer (ODP) | None |
| | Potential incidence of disease due to PM emissions (PM) | None |
| ILCD type / level 2 | AAcidification potential, Accumulated Exceedance (AP) | None |
| | Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater) | None |
| | Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine) | None |
| | Eutrophication potential, Accumulated Exceedance (EP-terrestrial) | None |
| | Formation potential of tropospheric ozone (POCP) | None |
| | Potential Human exposure efficiency relative to U235 (IRP) | 1 |
| ILCD type / level 3 | Abiotic depletion potential for non-fossil resources (ADP-minerals&metals) | 2 |
| | Abiotic depletion potential for fossil resources (ADP-fossil) | 2 |
| | Water (user) deprivation potential, deprivation-weighted water consumption (WDP) | 2 |
| | Potential Comparative Toxic Unit for ecosystems (ETP-fw) | 2 |
| | Potential Comparative Toxic Unit for humans (HTP-c) | 2 |

# 4 Results

| ILCD classification | Indicator | Disclaimer |
|---|---|---|
| | Potential Comparative Toxic Unit for humans (HTP-nc) | 2 |
| | Potential Soil quality index (SQP) | 2 |

**Disclaimer 1** – 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

**Disclaimer 2** – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

## 4.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

### PARAMETERS DESCRIBING RESOURCE USE

| Abbreviation | Unit | A1 | A2 | A3 |
|---|---|---|---|---|
| PERE | MJ | 0.00E+0 | 1.27E-1 | 1.34E+0 |
| PERM | MJ | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| PERT | MJ | 0.00E+0 | 1.27E-1 | 1.34E+0 |
| PENRE | MJ | 0.00E+0 | 1.08E+1 | 1.38E+2 |
| PENRM | MJ | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| PENRT | MJ | 0.00E+0 | 1.08E+1 | 1.38E+2 |
| SM | Kg | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| RSF | MJ | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| NRSF | MJ | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| FW | M3 | 0.00E+0 | 1.24E-3 | -1.04E+0 |

**PERE**=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water

# 4 Results

### OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

| Abbreviation | Unit | A1 | A2 | A3 |
|---|---|---|---|---|
| HWD | Kg | 0.00E+0 | 2.58E-5 | 3.46E-4 |
| NHWD | Kg | 0.00E+0 | 6.46E-1 | 2.03E+1 |
| RWD | Kg | 0.00E+0 | 6.68E-5 | 8.83E-4 |

**HWD**=hazardous waste disposed | **NHWD**=non hazardous waste disposed | **RWD**=radioactive waste disposed

### ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

| Abbreviation | Unit | A1 | A2 | A3 |
|---|---|---|---|---|
| CRU | Kg | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| MFR | Kg | 0.00E+0 | 0.00E+0 | 9.90E+2 |
| MER | Kg | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| EET | MJ | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| EEE | MJ | 0.00E+0 | 0.00E+0 | 0.00E+0 |

**CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

# 4 Results

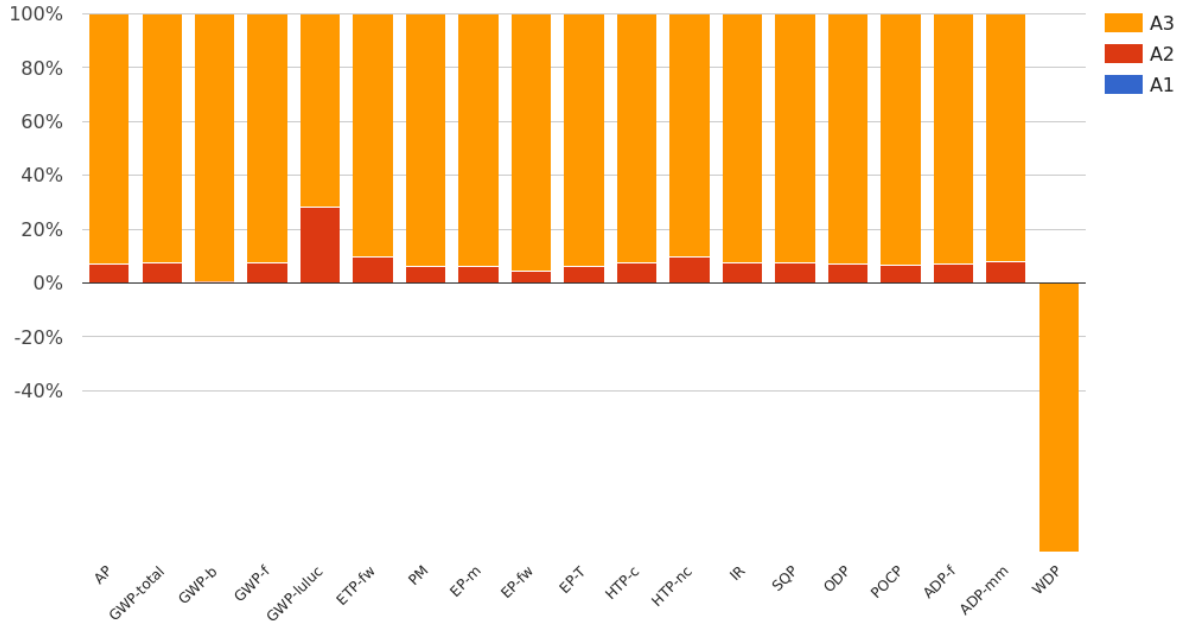
## 4.3 INFORMATION ON BIOGENIC CARBON CONTENT PER TON

### BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per ton:

| Biogenic carbon content | Amount | Unit |
|---|---|---|
| Biogenic carbon content in the product | 0 | kg C |
| Biogenic carbon content in accompanying packaging | 0 | kg C |

# 5 Interpretation of results




Production processes (A3) are outweighing all the other included modules in every single environmental impact category. This mostly stems from the overburdening process. As the only raw material (A1) of the product is the free-of-burden gravel, it has no impact. Transportation (A2) of the raw materials only happens on site with very short distances and is, thus, also less significant than A3.

# 6 References

**ISO 14040**
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

**ISO 14044**
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

**ISO 14025**
ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

**EN 15804+A2**
EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

**General PCR Ecobility Experts**
Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules (2022-02-14)

**Specific PCR Natural aggregates**
Institute Construction and Environment e.V. (IBU) - Part B: Requirements on the EPD for Natural aggregates (2023-07-04)

# 7 Contact information

| Publisher | Operator | Owner of declaration |
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