ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Lanxess Deutschland GmbH, BU Inorganic Pigments
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-LAN-20230193-IBC1-EN
Issue date	10.08.2023
Valid to	09.08.2028

Iron Hydroxide Yellow Pigment (FeOOH)

Lanxess Deutschland GmbH

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

Lanxess Deutschland GmbH

Programme holder

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

Declaration number

EPD-LAN-20230193-IBC1-EN

This declaration is based on the product category rules:

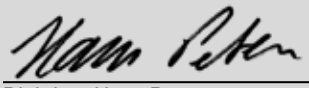
Inorganic Pigments in Various Forms of Delivery, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

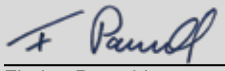
10.08.2023

Valid to

09.08.2028



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



Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Iron Hydroxide Yellow Pigment (FeOOH)

Owner of the declaration

Lanxess Deutschland GmbH, BU Inorganic Pigments
Rheinuferstr. 7 - 9
47829 Krefeld
Germany

Declared product / declared unit

1,000 kg iron hydroxide yellow pigment
(weighted average)

Scope:

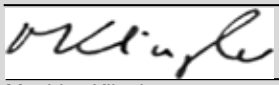
This EPD applies to iron hydroxide yellow pigments in the versions compacted, powder, granulate and micronized (different versions for each of the brand names). It is an average EPD for which the weighted average of the five versions was calculated on the basis of the mass-specific production rate of the year 2021. Production of the pigments from one factory in Germany was assessed.

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



Matthias Klingler,
(Independent verifier)

LANXESS
Energizing Chemistry

2. Product

2.1 Product description/Product definition

Inorganic pigments are defined as substances that are insoluble in the application medium (*ISO 18451-1*) and manufactured by means of chemical synthesis. This EPD covers the product iron hydroxide yellow pigment in its typical versions, namely powder, granulate, compacted and micronized.

The average values of the inorganic pigments declared here are based on the product volume in the indicated versions.

Regulation (EU) no. 305/2011 (CPR) applies to the placing of the product on the market in the EU/EFTA (except Switzerland). The product requires a declaration of performance with due consideration of *DIN EN 12878:2014* Pigments for the colouring of building materials based on cement and/or lime - Specifications and methods of test, and CE marking. The respective national provisions apply to use.

2.2 Application

Inorganic iron oxide pigments are used for colouring building materials made from cement, cement/lime mixtures, lime mortar, and bituminous applications. Other applications include use in paints and coatings as well as plastics.

2.3 Technical Data

The product technical data that comes within the scope of the EPD is set out in the table below, with reference to the check rules based on *EN 12878*.

Structural data - Influence on cement properties

Name	Value	Unit
Setting time (start of setting process min. 1h)	160	min
Setting time (end of setting time max. 12h)	260	min
Influence on cement setting (delta mixture with and without pigment max. + 60 min.)	-47	min
Compressive strength (mortar 28 days (compare mixture with and without pigment)) (category A)	-0.8	N/mm^2
Compressive strength (mortar 28 days (compare mixture with and without pigment)) (category B, max. -8%)	-1.9	N/mm^2
Chloride content (total chloride; category A)	0.14	%
Chloride content (total chloride; category B, max. 0.1%)	0.03	%
Soluble chloride content (category A)	0.07	%
Soluble chloride content (total chloride; category B, max. 0.1%)	0.03	%
Content of water-soluble substances (category A)	1.14	%
Content of water-soluble substances (category B, max. 0.5%)	1.29	%

*) Provided that the water-soluble content complies with EN 934-1.

The amount of water-soluble substances as defined by *EN 934-1*, paragraph 5.2.3, must not exceed:

- Category A: the level stated by the manufacturer
- Category B: 0.5 % by mass for individual pigments and pigment mixtures. If additives such as dispersants, binders, and/or grinding aids are used for powder or non-powder preparations, their water-soluble total content must be equal to or less than 5.5 % by mass (8.0 % for carbon black) in relation to the solid. The additives used must comply with *EN 934-1*, annex A.1.

The extremal values (worst-case assessment) across the three assessed versions are used to prove conformity with the standard.

Performance figures for the product in line with the declaration of performance in relation to its key characteristics as per *DIN EN 12878:2014* Pigments for the colouring of building materials based on cement and/or lime - Specifications and methods of test.

2.4 Delivery status

Typical versions of the iron hydroxide yellow pigment are powder, compacted, granulate and micronized. The packaging typically ranges from 25 kg polyethylene (PE) / paper sacks to big bags with a net weight of one metric ton. The calculations in this EPD are based on an assessment of big-bag material. As the packaging material accounts for a very small proportion of the calculated environmental impacts, only big bags made from polypropylene (PP) and low-density polyethylene (LDPE) were assessed as the packaging material.

2.5 Base materials/Ancillary materials

On average, iron hydroxide yellow pigment is made up of the following raw and auxiliary materials:

Name	Value	Unit
Sodium hydroxide	58,0	%
Ferrous sulfate	31,6	%
Aluminum sulfate	3,2	%
Sodium aluminate	2,2	%
Iron pellets (93%)	1,5	%
Iron (II) chloride	1,4	%
Phosphoric acid	0,3	%
Iron scrap	0,2	%
Aluminum chloride	0,1	%
Cooling water	1,6	%

1) The product/at least one partial product contains substances on the *ECHA* list of substances of very high concern (SVHC) (date July 8, 2021) above 0.1 % by mass: No.

2) The product/at least one partial product contains further carcinogenic, mutagenic, reprotoxic (CMR) substances in category 1A or 1B that are not on the candidate list, above 0.1 % by mass in at least one partial product: No.

3) This construction product has had biocidal products added to it, or it has been treated with biocidal products (it is therefore a treated article as per the *Biocidal Products Regulation (EU) no. 528/2012)*: No

2.6 Manufacture

A solution of iron sulfate that is designated as waste product from the steel industry is mixed with sodium hydroxide in a controlled manner with the addition of air or oxygen.

$$2\ FeSO_4 + 4\ NaOH + ½\ O_2 \rightarrow 2\ FeOOH + 2\ Na_2SO_4 + H_2O$$

After subsequent drying, washing is carried out, followed by grinding.

2.7 Environment and health during manufacturing

LANXESS is continuously investing in modern manufacturing processes at all locations. The Inorganic Pigments business unit and its equipment are certified according to *ISO 9001, 14001, and 50001*.

Iron oxide pigments are certified by *SCS Global Services* for their high content of recycled raw materials.

2.8 Product processing/Installation

As this EPD assesses modules A1–A3 (cradle to gate); a rough description of the application processes is attached.

Customers typically use dosing units to dose iron oxide pigments into specific color mixtures and to process them into cement-bound, lime-bound, orbituminous products.

2.9 Packaging

All versions of the pigments are packaged identically. The finished product is usually packaged in PE/paper sacks with a net weight of 25 kg through to big bags made of PP and LDPE with a net weight of one metric ton.

According to the German Association for Plastics Packaging and Films (IK), the big bags made of PP and LDPE on which the calculations of the EPD are based can be reused in a closed-loop system under specific conditions for the same product (max. 2 years). The big bags can be recycled at the end of their life. For mechanical recycling, the used synthetic fabrics are treated mechanically with no change to the chemical structure. The recycled materials can be used in various applications and replace new granulate.

2.10 Condition of use

This EPD assesses modules A1–A3 (cradle to gate). No material changes are expected within the recommended usage limits.

2.11 Environment and health during use

The product is not a hazardous substance (as per the *CLP Regulation*). There is no risk if the product is handled and processed in compliance with the applicable regulations in the workplace.

2.12 Reference service life

This EPD assesses modules A1–A3 (cradle to gate). The service life corresponds to typical use in the respective application

2.13 Extraordinary effects

Fire

FeOOH is non-flammable.

Water

No hazardous substances are released as a result of contact with water.

Mechanical destruction

Not applicable.

2.14 Re-use phase

This EPD assesses modules A1–A3 (cradle to gate). As iron hydroxide yellow pigments are bound in the application medium, reuse is not pursued on account of the substantial amount of thermal energy required and the technical options currently available. Recycling management provides individual opportunities for the use of the bound pigment.

2.15 Disposal

Disposal is carried out in conjunction with and in accordance with the respective application medium.
The waste code for iron oxide is 060316 (as per the *German Waste Catalog Ordinance*).

2.16 Further information

Further information on iron hydroxide yellow pigments and further Lanxess IPG products and services is available at www.bayferrox.com

3. LCA: Calculation rules

3.1 Declared Unit

The selected declared unit relates to an average product. The average was formed as a weighted mean from the annual production quantities of the compacted, powder, granulate and micronized versions in the year 2021 (reference to mass).

Declared unit and mass reference

Name	Value	Unit
Declared unit	1000	kg

3.2 System boundary

Type of EPD: Cradle to gate with options
Only modules A1 to A3 were calculated because the pigment fulfills all of the below criteria, as stated in PCR Part A:

- the product is physically integrated with other products during installation so they cannot be physically separated from them at the end of life,
- the product is no longer identifiable at the end of life as a result of a physical or chemical transformation process,
- the product does not contain biogenic carbon.

The following modules were taken into account in the LCA calculation
A1: Supply of raw materials
A2: Transportation of raw materials to the manufacturer
A3: Manufacture of the product (including required energy and water) and manufacture of the product packaging

3.3 Estimates and assumptions

Primary data across all versions were used for transportation of the iron filings (module A2) and for on-site production processes at Lanxess Deutschland GmbH (module A3). A distance of 1,000 km (within Europe) was assumed for transportation of all further input materials (module A2). Electricity consumption of 0.072 MJ per t km was assumed for transportation via pipeline.

Generic data was used for the production of raw materials (module A1) as these are not produced by Lanxess Deutschland GmbH itself and no detailed information was available.

Credits for the avoidance of generation of electricity and steam in another product system through the incineration processes

for production waste were also taken into account. 100 % incineration including energy recovery in the closed-loop method to A3 (electricity and steam) was assumed here.

3.4 Cut-off criteria

All primary data of the production processes were taken into account. No cut-off rules were applied.

3.5 Background data

The software system GaBi 10 developed by Sphera was used for modelling the product's LCA. The data sets contained therein are either from the *GaBi Professional* database (v 2023.1) or from the *Ecoinvent* database (v 3.8).

3.6 Data quality

The *GaBi software* system for life-cycle analyses and the GaBi Professional database (v 2023.1), as well as the *Ecoinvent* database (v 3.8) were used for life-cycle modeling of the assessed products. The produced quantities for 2022 were gathered by Lanxess.

Corresponding data sets were available for the input materials used, and some of them have been adapted with regard to concentration. The age of the background data used (2018–2021) is less than 15 years and can be regarded as representative for the assessment period.

The LCA figures for the average EPD (weighted mean for the year 2021) can be regarded as robust as they are a weighted average of high-quality, measured activity data. All data used can be regarded as representative.

3.7 Period under review

The assessment period is 2021. All in-house data was gathered in this period and then correspondingly subjected to average weighting for the average assessment.

3.8 Geographic Representativeness

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

3.9 Allocation

Module A1 does not take account of any debits for the iron sulfate used as this is pre-consumer material as per *ISO 14021*. Some of the material used stems from ilmenite treatment at a titanium dioxide factory, and some of it stems from pig-iron pickling plants in the steel industry.

All credits from recovered energy from processes relating to the incineration of production waste were allocated to A3 with the closed-loop method.

3.10 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. Background data was taken from the *GaBi Professional database (v 2023.1)*. To fill occasional gaps, datasets from the *Ecoinvent database* (v 3.8) were used.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The content of biogenic carbon in the product is 0 %. The product packaging consists of plastic (PP) without biogenic content.

Technical Information

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

As disposal of the packaging material on the buildingsite (module A5) is not declared, the assessed quantities of packaging materials are stated below:

- Big bag (PP): 2.05 kg/1,000 kg product
- Big bag (LDPE): 0.72 kg/1,000 kg product

5. LCA: Results

The following tables show the environment-relevant results as per *EN 15804* for 1,000 kg iron hydroxide yellow pigment (weighted average for the compacted, powder, granulate and two micronized versions.).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = 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	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1000 kg Iron Hydroxide Yellow Pigment

Parameter	Unit	A1-A3	A1	A2	A3
Global Warming Potential total (GWP-total)	kg CO_2 eq	2.22E+03	1.05E+03	1.54E+02	1.01E+03
Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq	2.19E+03	1.04E+03	1.54E+02	9.94E+02
Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq	2.91E+01	9.19E+00	-5.7E-01	2.05E+01
Global Warming Potential luluc (GWP-luluc)	kg CO_2 eq	1.22E+00	5.88E-01	5.85E-01	4.88E-02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	5.18E-06	5.18E-06	7.88E-11	9.82E-10
Acidification potential of land and water (AP)	mol H^+ eq	4.08E+00	2.88E+00	4.12E-01	7.82E-01
Eutrophication potential aquatic freshwater (EP-freshwater)	kg P eq	3.76E-02	3.71E-02	3.12E-04	1.71E-04
Eutrophication potential aquatic marine (EP-marine)	kg N eq	1.17E+00	6.73E-01	1.86E-01	3.07E-01
Eutrophication potential terrestrial (EP-terrestrial)	mol N eq	1.31E+01	7.66E+00	2.08E+00	3.37E+00
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	2.99E+00	1.75E+00	3.77E-01	8.59E-01
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb eq	2.26E-03	2.19E-03	1.62E-05	5.73E-05
Abiotic depletion potential for fossil resources (ADPF)	MJ	3.28E+04	1.5E+04	2.04E+03	1.57E+04
Water use (WDP)	m^3 world eq deprived	8.22E+01	6.87E+01	7E-01	1.29E+01

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1000 kg Iron Hydroxide Yellow Pigment

Parameter	Unit	A1-A3	A1	A2	A3
Renewable primary energy as energy carrier (PERE)	MJ	7.06E+03	6.56E+03	1.54E+02	3.42E+02
Renewable primary energy resources as material utilization (PERM)	MJ	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	7.06E+03	6.56E+03	1.54E+02	3.42E+02
Non renewable primary energy as energy carrier (PENRE)	MJ	3.28E+04	1.51E+04	2.04E+03	1.57E+04
Non renewable primary energy as material utilization (PENRM)	MJ	1.26E+02	0	0	1.26E+02
Total use of non renewable primary energy resources (PENRT)	MJ	3.29E+04	1.51E+04	2.04E+03	1.58E+04
Use of secondary material (SM)	kg	2.26E+03	2.26E+03	1.41E-02	2.72E-01
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0
Use of non renewable secondary fuels (NRSF)	MJ	0	3.27E-07	1.59E-09	6.16E-07
Use of net fresh water (FW)	m^3	1.29E+01	8.52E+00	1.17E+00	3.16E+00

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1000 kg Iron Hydroxide Yellow Pigment

Parameter	Unit	A1-A3	A1	A2	A3
Hazardous waste disposed (HWD)	kg	4.43E-06	1.66E-06	1.17E-08	2.76E-06
Non hazardous waste disposed (NHWD)	kg	3.69E+01	3E+01	3.54E-01	6.48E+00
Radioactive waste disposed (RWD)	kg	1.19E+00	7.27E-01	4.87E-03	4.54E-01
Components for re-use (CRU)	kg	0	0	0	0
Materials for recycling (MFR)	kg	0	0	0	0
Materials for energy recovery (MER)	kg	0	0	0	0
Exported electrical energy (EEE)	MJ	0	0	0	0
Exported thermal energy (EET)	MJ	0	0	0	0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1000 kg Iron Hydroxide Yellow Pigment

Parameter	Unit	A1-A3	A1	A2	A3
Incidence of disease due to PM emissions (PM)	Disease incidence	ND	ND	ND	ND
Human exposure efficiency relative to U235 (IR)	kBq U235 eq	ND	ND	ND	ND
Comparative toxic unit for ecosystems (ETP-fw)	CTUe	ND	ND	ND	ND

Comparative toxic unit for humans (carcinogenic) (HTP-c)	CTUh	ND	ND	ND	ND
Comparative toxic unit for humans (noncarcinogenic) (HTP-nc)	CTUh	ND	ND	ND	ND
Soil quality index (SQP)	SQP	ND	ND	ND	ND

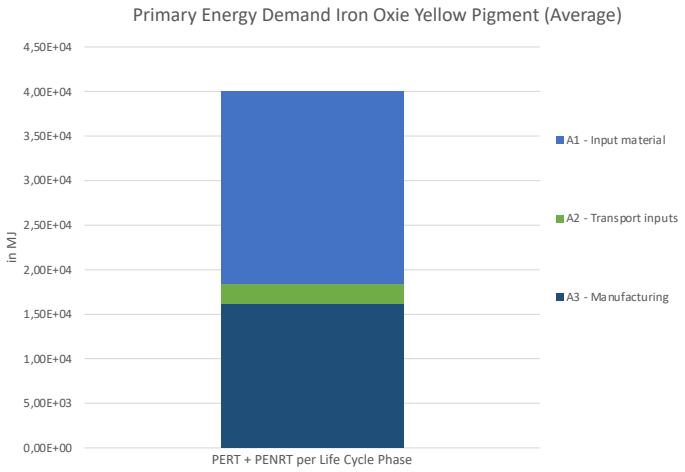
Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure 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.

6. LCA: Interpretation

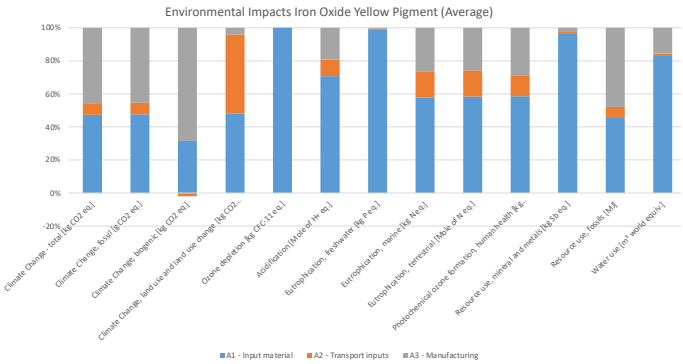
The product is evaluated below for the weighted average of the five versions, namely compacted, powder, granulate and micronized.

The largest share of the gross energy demand is attributed in each case to the production of raw materials (A1) (approx. 21,600 MJ, 54 %). The transport of the raw materials requires approx. 6 % of the energy expenditures (A2) in each case, while the production process accounts for a share of 40 %.



The environmental impact categories are significantly influenced (at least 46 %) by the provision of raw materials (module A1). The only exceptions is the category Climate Change, Biogenic, where the greatest influence lies in the manufacturing processes (Module A3) or in the transport of the input materials (Module A2).

With the exception of the Climate Change, Land Use category, the transportation processes do not have a significant impact on the environmental impact of the products. The share of the manufacturing processes (A3) in the individual categories is between 0 % and 48 % in all categories. In the impact category Climate Change, biogenic, the influences is at 70 %.



The results of the different product types do not differ significantly. In the Climate Change- total category, the variation of the results is between 2-9 %. Only in individual environmental categories they differ. The granulate pigments are having an higher value in the Climate Change-biogenic category, due to an increased waste content. Overall, the micronized delivery form of the COLORTHERM® brand has the most deviations from the weighted average. In particular, the results differ in the categories Resource use - fossils and Water use. The differences can be explained by variations in the recipes. With the exception of the Colortherm® form, all pigments are produced only from two raw materials, of which one, iron sulfate is calculated as burden-free (pre-consumer waste). For more details between the five delivery forms see the appendix.

In Module A3 (manufacturing process), the environmental impacts for all colors are essentially dominated by the use of electricity and natural gas. The only exceptions are the categories Climate Change, Biogenic and Water Removal Potential (WDP), which mainly reflect the incineration of industrial waste or, in some delivery forms of the yellow pigment, the use of compressed air.

When interpreting the results, it should be noted that various assumptions and estimates were made. This mainly concerns the transports to the plant. It can be assumed that the influence on the overall result is not significant even with variations in the assumptions / estimates made, since transports do not have a major influence.

7. Requisite evidence

According to PCR Part B no proofs are required.

8. References

Standards

EN 934-1
DIN EN 934-1:2008-04, Admixtures for concrete, mortar, and grout - Part 1: Common requirements.

EN 12878
DIN EN 12878:2014, Pigments for the coloring of building materials based on cement and/or lime -Specifications and methods of test.

EN 15804
DIN EN 15804:2012-04+A1 2013, Sustainability of onstruction works – Environmental product declarations – Core rules for the product category ofconstruction products.

ISO 9001
DIN EN ISO 9001:2015, Quality management systems–Requirements.

ISO 14001
DIN EN ISO 14001:2015, Environmental management systems - Requirements with guidance for use.

ISO 14021
DIN EN ISO 14021:2016, Environmental labels and declarations – Self-declared environmental claims (Type II environmental labeling).

ISO 14025
DIN EN ISO 14025:2011-10, Environmental labels and declarations – Type III environmental declarations –Principles and procedures.

ISO 18451-1
DIN EN ISO 18451-1:2019, Pigments, dyestuffs, and extenders - Terminology - Part 1: General terms.

ISO 50001
DIN EN ISO 50001:2018, Energy management systems - Requirements with guidance for use.

Further literature

CPR Regulation
Regulation (EU) No 305/2011 of the European Parliament and of the Council of March 2011, laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

ECHA
European Chemicals Agency: Candidate List of substances of very high concern, 2022

BPR Regulation
Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of the biocidal products (Text with EES relevance)

SCS Global Services
Scientific Certification Systems.
https://www.scsglobalservices.com/

German Waste Catalog Ordinance (AVV)
Ordinance on the European List of Waste, WasteCatalog Ordinance dated December 10, 2001 (GermanFederal Gazette I p. 3379), last amended by Article 1of the Ordinance dated June 30, 2020 (GermanFederal Gazette I p. 1533).

CLP Regulation
Regulation (EG) no. 1272/2008 of the European Parliament and of the Council of December 16, 2008,on classification, labeling, and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, andamending Regulation (EC) no. 1907/2006 (Official Journal L 353 dated December 31, 2008, p. 1–1355), last amended by Delegated Regulation (EU)2021/1962 of the Commission dated August 12, 2021 (Official Journal L 400/16).

Ecoinvent database
Ecoinvent database version 3.8, 2021

GaBi Professional database
GaBi Professional database version 10.2, 2022

IBU 2021
Institut Bauen und Umwelt e.V.: General guide for theEPD program of the Institut Bauen und Umwelt e.V.(IBU). Version 2.0, Berlin: Institut Bauen und Umwelte.V., 2021.www.ibu-epd.com

PCR part A
Product category rules for building-related productsand services. Part A: Calculation rules for the LCA andrequirements for the background report, v. 2.0. Berlin:Institut Bauen und Umwelt e.V. (publisher), 2021.

PCR: Inorganic pigments in different versions
Product category rules for building-related productsand services. Part B: Requirements for the EPD forinorganic pigments in different versions, v.1.0. Berlin:Institut Bauen und Umwelt e.V. (publisher), 2021.

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