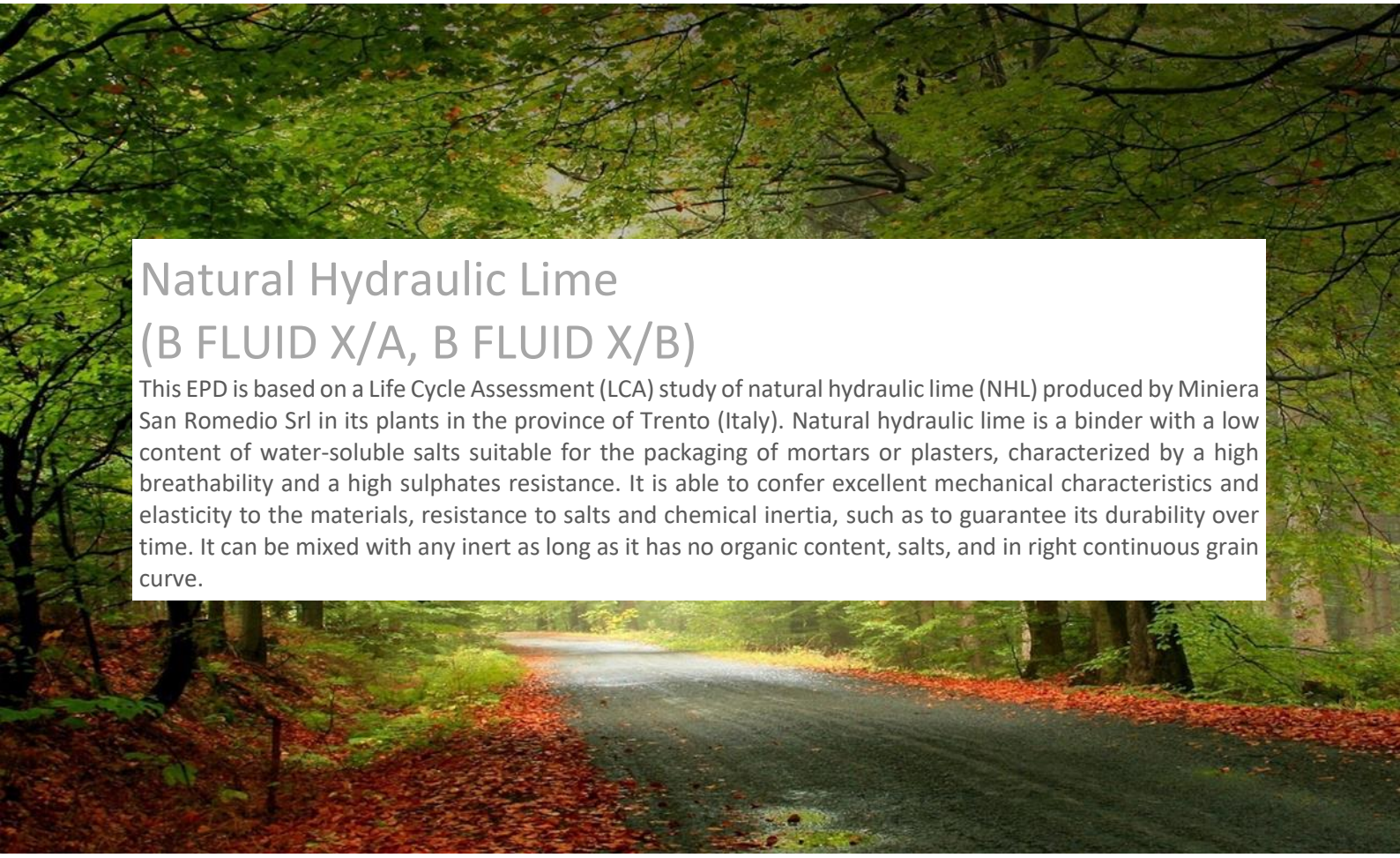
Environmental Product Declaration

as per ISO 14025 and EN 15804 +A1

Owner of the declaration:	Miniera San Romedio Srl
Publisher:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Programme holder:	Kiwa BCS Öko-Garantie GmbH - Ecobility Experts
Declaration number:	EPD-Miniera San Romedio Srl-83-EN
Issue date:	20.07.2020
Valid to:	19.07.2025



Natural Hydraulic Lime (B FLUID X/A, B FLUID X/B)

This EPD is based on a Life Cycle Assessment (LCA) study of natural hydraulic lime (NHL) produced by Miniera San Romedio Srl in its plants in the province of Trento (Italy). Natural hydraulic lime is a binder with a low content of water-soluble salts suitable for the packaging of mortars or plasters, characterized by a high breathability and a high sulphates resistance. It is able to confer excellent mechanical characteristics and elasticity to the materials, resistance to salts and chemical inertia, such as to guarantee its durability over time. It can be mixed with any inert as long as it has no organic content, salts, and in right continuous grain curve.

1. General information

Miniera San Romedio Srl

Programme holder
Kiwa BCS Öko-Garantie GmbH
- Ecobility Experts
Marientorbogen 3-5
90402 Nürnberg (Germany)

Declaration number
EPD-Miniera San Romedio Srl-83-EN

This declaration is based on the Product Category Rules
UNI EN 16908

Issue date
20.07.2020

Valid to
19.07.2025

Signature
Frank Huppertz
(President of Kiwa BCS Öko-Garantie GmbH – Ecobility Experts GmbH)

Signature
Prof. Dr. Frank Heimbecher
(Chairman of the independent expert committee BCS Öko-Garantie GmbH – Ecobility Experts GmbH)

Natural Hydraulic Lime

Owner of the declaration
Miniera San Romedio Srl
Località alla Miniera 38012 Predaia (TN) - Italy
VAT Number 00602230229

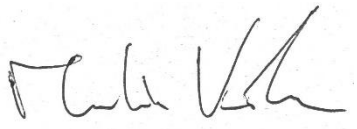
Declared product / declared unit
1 ton (1000 kg) of neat Natural Hydraulic Lime (NHL)

Scope
This EPD refers to natural hydraulic lime (NHL) produced by Miniera San Romedio Srl in its plants in the province of Trento (Italy).
The data used to perform the LCA analysis were provided by Miniera San Romedio Srl and referred to the production of one year, and the information are relative to the period 2017-2018. This EPD is intended to be used for business-to-consumer communications. The owner of the declaration is liable for the underlying information and evidence.
Kiwa BCS Öko-Garantie GmbH – Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification
The CEN Norm EN 15804:2012+A1:2013 serves as the core PCR.

Independent verification of the declaration and data according to ISO 14025:2011-10

☐internally ☒externally



Signature
Martin Köhrer
(External verifier of Kiwa GmbH)

2. Product

2.1 Product description

The premixed Miniera San Romedio's products are inorganic finely grinded materials, obtained by means of the combinations at different relative concentrations of natural hydraulic lime, acting as the inorganic binder, and the fillers (i.e. dolomia, expanded perlite). In this EPD, only the binder constituted by Natural Hydraulic Lime (B FLUID X/A, B FLUID X/B) is considered.

2.2 Application

Natural hydraulic lime binder has a low content of water-soluble salts, and it is suitable for the packaging of mortars or plasters, it is characterized by a high breathability and a high sulphates resistance. It is obtained from the cooking at low temperatures of natural marlstone with Trentino red flakes (clay limestone) known as "Scaglia Rossa", the main mineralogical constituent is the bi-silicatecalcic, able to confer excellent mechanical characteristics and elasticity to the materials, resistance to salts and chemical inertia, such as to guarantee its durability over time. It is tricalcium silicate and tricalcium aluminate free, typical constituents that can be found in Portland cements and in any other form of clinker. It can be mixed with any inert as long as it has no organic content, salts, and in right continuous grain curve.

2.3 Technical Data

In Table 1 the main physical and applicative properties of the considered product are reported. It is usually applied as premixed product, in combinations with different amounts of inerts (dolomia, expanded perlite).

Table 1: Physical and applicative properties of the NHL developed by Miniera San Romedio Srl.

Name	Value	Unit
Classification (UNI EN 459-1)	NHL 5	-
Appearance density (UNI EN 459-2)	1600	kg/m^3
Setting time	60	min
Mechanical resistance after 2 days	> 2	N/m^2
Mechanical resistance after 28 days	> 5	N/m^2
Fineness	< 5	%
pH-value	> 10.5	-
Fire reaction class	A1	-

2.4 Placing on the market / Application rules

Accordingly to UNI EN 459-1:2010 ("Building lime - Part 1: Definitions, specifications and conformity criteria"), it is classified as NHL5 and subject to CE marking according to current legislation. The NHL binder is sold in form of powder or granulates, and therefore it has to be transported to the building site by using 25 kg to 30 kg paper bags, collected over a pellet. Pellets range from 50 to 60 bags each one, and can be mechanically moved. Once the product reaches the building site the bags can be used to mix the product with the specified amount of water (and inerts) and either be manually stirred or mechanically mixed. This product can be also transported to the construction site unpackaged and directly pumped into a silo already settled on a nearby position.

2.5 Base materials / Ancillary materials

In order to apply this product, it must be premixed combining at different relative concentrations natural hydraulic lime, acting as the inorganic binder, and the fillers (i.e dolomia, expanded perlite). Water and small amounts of additives (less than 3 wt%) are then added to the mix, in order to develop innovative materials with very peculiar properties and suitable for a wide range of applications in the constructions field. The relative composition of the binder is summarized in Table 2.

Table 2: Composition of the binder, as declared by Miniera San Romedio Srl.

Product	Dolomia [wt%]	Expanded perlite [wt%]	NHL* [wt%]	Additives [wt%]
Binder (Natural Hydraulic Lime)	-	-	100	-

* Comprising setting retardant (4 wt% of the total NHL content)

2.6 Manufacture

The unprocessed marlstone is extracted from the pit in Predaia (TN), through a mixed explosive. The obtained marlstone is then collected through a Diesel bulldozer and transported with a Diesel lorry from Predaia (TN) to the Ville d'Anaunia (TN) facility, where the material is subjected to a first crushing. After the first crushing of the marlstone, part of this material is used as corrective and it is not crushed anymore, but it is transported into a specific hopper. Through a conveyor belt the crushed marlstone that is not intended to be used as corrective is then transported to the cooking plant, fed with hard coal. In the cooking plant the material is subjected to a slow thermal treatment at 900-1200 °C, that can last up to 48 hours, and the treated material is then transported through a conveyor belt in the maturation hopper. After the thermal treatment, the material is then subjected to a first and a second milling phase, in order to reach the required granulometry. After the second milling phase, the different fractions of the resulting lime are separated through a cyclonic separator, and about the 33% of the milled material is reintroduced in the ball miller, in order to have a further size reduction. The lime based end product (i.e. the binder) is obtained mixing the milled lime, the setting retardant and the corrective marlstone (i.e. the marlstone extracted from the pit of Predaia, transported to the cooking plant, milled and not subjected to the thermal treatment). The mixed material is then put in a paper bag of 25 kg to 30 kg through a bagging machine and directly distributed.

2.7 Reference Service Life

According EN 15804 +A1 and UNI EN 16908 standards, the reference service life (RSL) of this product does not have to be declared, because this EPD is based on a "cradle to gate" approach, it considers only the A1-A3 phases, and it does not declare the entire life cycle.

3. LCA: Calculation rules

3.1 Declared unit

The LCA study was performed on the declared unit of 1 ton (1000 kg) of end product (natural NHL). The choice of the declared unit was performed according to the EN 15804 +A1 and UNI EN 16908 standards.

3.2 System boundary

According to the EN 15804 +A1 standard, this study considers a "cradle-to-gate" analysis (stages A1-A3), covering the following stages:

- Extraction and processing of the raw materials (A1)
- Transport of the acquired raw materials to the manufacturer and internal transport of the extracted raw materials (A2)
- Production of the materials and mixing operations (A3).

Therefore, the phases related to the transport to the site (A4), the on-site processes (A5), to the use stage (B1-B7) and the end of life stages (C1-C4) were not taken into account. Also, the benefits beyond the system boundaries (D) were not considered.

The internal transportations from one working site to another were considered, as well as the transport of the raw materials purchased from other companies. For all the considered life cycle phases, the provision of all materials, products and energy as well as the complete waste treatment up to the end of the waste status or disposal of residual waste were considered.

The main types of generated waste in this process could be powder waste, paper (paper bags) and foil. Also waste oil (maintenance) and wood (pallets) could be present. All these waste types, if present, are separated, stored and redirected to the recycling circuit or disposed of. However, according to the information provided by Miniera San Romedio Srl, all the extracted material can be processed without any appreciable loss of product. In the same way, also in the production phase the losses of powder and of packaging materials are negligible. Moreover, the production of the binder is completely performed by using virgin raw materials, without the use and/or the recovery of recycled products. In the analyzed system also secondary fuels are absent.

3.3 Estimates and assumptions

The electrical energy consumed in Miniera San Romedio Srl plants is a fully renewable certified energy. The 100% of the electrical energy comes from renewable energy sources (hydro-electric plants). The electrical energy is converted from the high voltage to low voltage using an electrical transformer located close to the plants. The certification of the renewability of the energy covers to whole period analyzed in this study (2017-2018) and is still valid. For as concerns the energy source to feed the furnace for the NHL production, hard coal, with a total heat evolution of 787 Mcal to cook 1 ton of NHL, was considered. For the internal transportations, gasoline with a calorific power of 45 MJ/kg was considered. For the EPD of this product, allocations have been avoided as far as possible (e.g. by system expansion, splitting processes into sub-processes).

3.4 Cut-off criteria

As reported in the EN 15804 +A1 standard, all inputs and outputs for which data are available were taken into account in the calculation. Eventual data gaps have been filled with conservative assumptions of average data or generic data available in the Ecoinvent v3.5 database (released in 2018) of the SimaPro software. All flows contributing to more than 1 % of the total mass, energy or environmental impact of the system have been included in the life cycle assessment. Eventual neglected processes do not contribute in total more than 5% to the impact categories considered. Because of these reasons, the influence of the additives present in the compositions of the binder has been neglected. Moreover, the manufacture of machinery, plants and other infrastructure required for production of the products under review was not taken into consideration in the present analysis.

3.5 Period under review

The specific data were obtained directly by the commissioning company, and are related to the production of one year. The data are referred to the period June 2017-June 2018. They were obtained by means of specific measures related to the energy consumption and mass flows in the plant of Ville d'Anaunia (Trento), where the NHL is produced. Manufacturer-specific data are referred to the period 2017-2018, while generic data are less than 10 years old. Moreover, process-specific data are based on the average of an operating year.

3.6 Comparability

In order to assure the comparability of the obtained results, all datasets to be compared have been created in accordance with EN 15804, and the product-specific performance characteristics have been taken into account. 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.

4. LCA: Results

In Table 3 the results referred to the LCA of the Binder are reported.

Table 3: LCA results of the Binder.

Description of the system boundary (X = Included in LCA; MND = Module not declared)															
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 manufacturer to place of use	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishmen	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Results of the LCA –Environmental impact: Binder		
Parameter	**Unit**	**A1-A3**
Global warming potential	[kg CO_2-Eq.]	4.46E+02
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.20E-05
Acidification potential of land and water	[kg SO_2-Eq.]	3.07E+00
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	9.57E-01
Formation potential of tropospheric ozone photchemical oxidants	[kg Ethen-Eq.]	1.80E-01
Abiotic depletion potential for non fossil resources	[kg Sb-Eq.]	2.13E-04
Abiotic depletion potential for fossil resources	[MJ]	5.25E+03

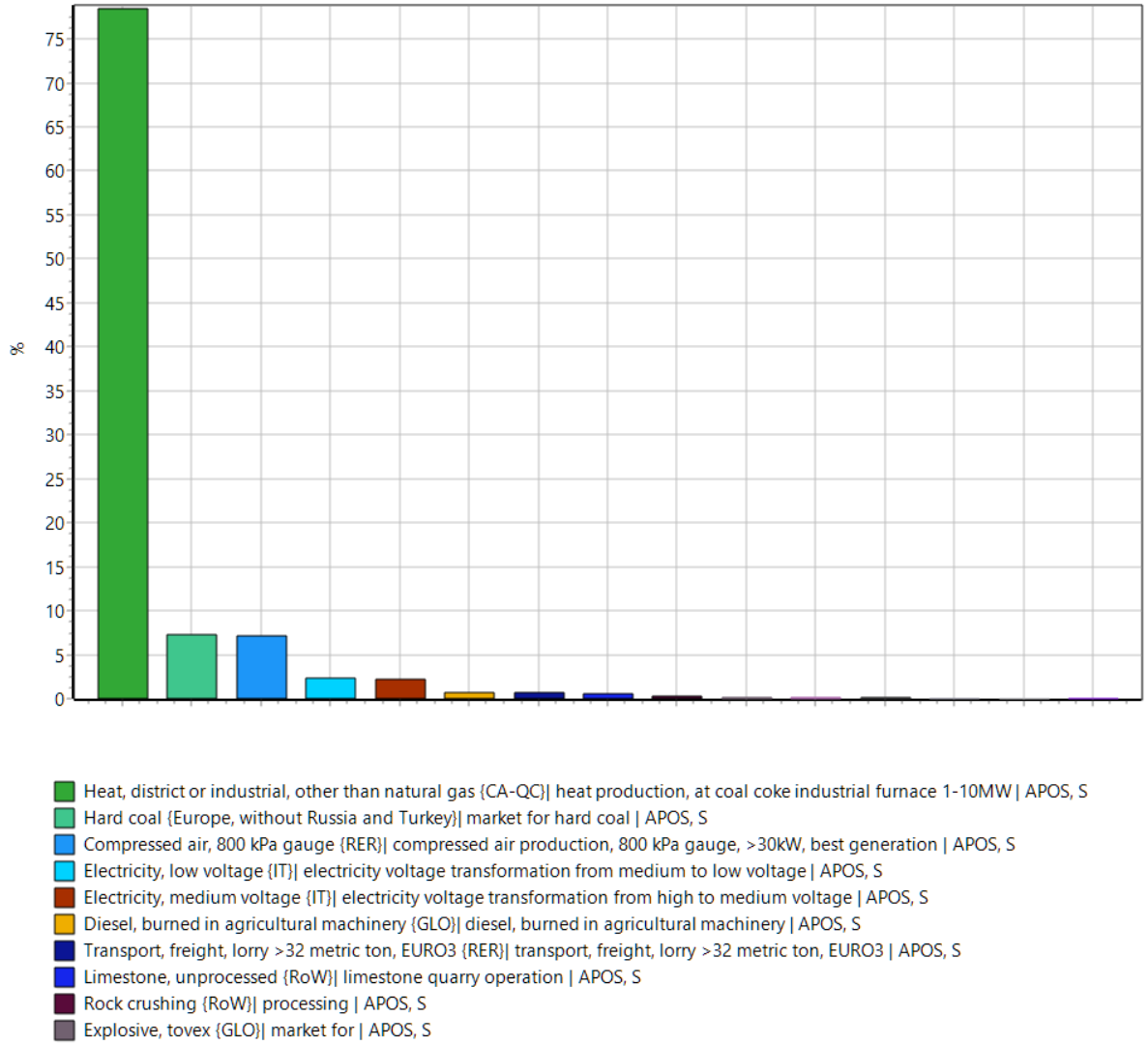
Results of the LCA –Resource use: Binder		
Parameter	**Unit**	**A1-A3**
Renewable primary energy as energy carrier	[MJ]	4.12E+02
Renewable primary energy resources as material utilization	[MJ]	IND
Total use of renewable primary energy resources	[MJ]	4.12E+02
Non renewable primary energy as energy carrier	[MJ]	6.00E+03
Non renewable primary energy as material utilization	[MJ]	IND
Total use of non renewable primary energy resources	[MJ]	6.00E+03
Use of secondary material	[kg]	IND
Use of renewable secondary fuels	[MJ]	IND
Use of non renewable secondary fuels	[MJ]	IND
Use of net fresh water	[m^3]	1,57E+04

Results of the LCA –Output flows and waste categories: Binder		
Parameter	**Unit**	**A1-A3**
Hazardous waste disposed	[kg]	3.11E-03
Non hazardous waste disposed	[kg]	IND
Radioactive waste disposed	[kg]	9.46E-03
Building materials for re-use	[kg]	IND
Materials for recycling	[kg]	1.00E+03
Materials for energy recovery	[kg]	IND
Exported energy	[MJ]	IND

5. LCA: Interpretation

In Figure 1 the relative contribution of the different inputs on the GWP of the Binder is reported. Even if natural hydraulic lime takes far less energy in the production process with respect to a traditional cement based mortar, due to lower processing temperatures and to the lower raw materials required, it can be seen that a considerable amount of the environmental impact (i.e. 78.4 %) is due to the coal furnace utilized for the thermal treatment of the raw materials (i.e. lime), taking also into account the provision of the coal for the furnance (7.2%). In this sense, changing the energy source and improving the efficiency of the lime furnace could lead to a strong reduction of the overall environmental impact, also in the other impact categories. Also the use of compressed air (7.1%) and of the electrical energy (4.5%) during the processing affect the environmental performance of the product. On the other hand, the rock crushing operations (0.2%), the extraction of the lime (0.6%) and the transport stages (0.7%) play a minor role.

Figure 1: Relative contribution of the different inputs on the GWP of the Binder.



6. References

- DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006 + Amd 1:2017); German version EN ISO 14044:2006 + A1:2018.
- DIN EN 15804:2014-07, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products; German version EN 15804:2012+A1:2013.
- CEN/TR 15941:2010-03: Sustainability of construction works - Environmental product declarations – Methodology for selection and use of generic data; German version CEN/TR 15941:2010.
- UNI EN ISO 14040:2006 – Environmental management – Life Cycle Assessment – Principles and framework.

Annex I. Requirements of the Minimum Environmental Criteria (DM October 11th 2017)

In Table 4 the requirements imposed by Minimum Environmental Criteria (DM October 11th 2017) for the NHL binder considered in this EPD are summarized. As it can be seen, this product satisfies the legislative requirements imposed by the Italian Legislation on the Minimum Environmental Criteria for construction services.

Table 4: Requirements of the Minimum Environmental Criteria (DM October 11th 2017) for the Natural Hydraulic Lime considered in this EPD.

Point 2.4 Technical specifications of the building components			
Point 2.4.1.1	Disassemblability	NHL considered in this EPD, after the dismantling operations, can be fully recovered and recycled.	
Point 2.4.1.2	Recovered of recycled material	NHL considered in this EPD is fully developed starting from virgin materials, as required for lime based products by D.Lgs. 152/2006.	
Point 2.4.1.3	Dangerous substances	NHL considered in this EPD does not contain additives with cadmium, lead, chromium VI, mercury, arsenic and selenium in concentration higher than 0.010 wt%.	
Point 2.4.2.1	Premixed concrete or prepared on the building site	NHL considered in this EPD is fully developed starting from virgin materials, as required for lime based products by D.Lgs. 152/2006.	This requirement can not be applied to this product, since it is a lime based product (see D.Lgs. 152/2006).
Point 2.5 Technical specifications of the building site			
Point 2.5.1	Dismantling and removal of the materials	NHL considered in this EPD, after the dismantling operations, can be fully sent to reuse, recovery and recycling operations.	

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