ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and ISO 21930:2017

SmartEPD-2023-003-0011-01

Fiberglass Batts (Unfaced)

Date of Issue: Jul 14, 2023

Expiration: Jul 14, 2028

Last updated: Jul 14, 2023

Insulation Institute
KNOWLEDGE. LEADERSHIP. CONFIDENCE.

SMART EPD
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION

General Information

EPD Holder:

NAIMA

2013 Olde Regent Way, Suite 150, Box 120, Leland, NC 28451

703-684-0084

sfitzgerald-redd@naima.org   insulationinstitute.org

Product Name:	Fiberglass Batts (Unfaced)
Functional Unit:	1 m2
Declaration Number:	SmartEPD-2023-003-0011-01
Date of Issue:	July 14, 2023
Expiration:	July 14, 2028
Last updated:	July 14, 2023
EPD Scope:	Cradle to gate with other options A1 – A3, A4, A5, C1, C2, C3, C4
Market(s) of Applicability:	North America

Reference Standards

Core PCR:

UL PCR for Building-Related Products and Services Part A v.3.1, ISO 21930:2017 — Date of issue: March 05, 2018

Sub-category PCR:

UL Part B: Building Envelope Thermal Insulation Products v.2 — Date of issue: April 10, 2018

Valid until: April 11, 2024

Sub-category PCR review panel: Contact Smart EPD for more information.

General Program Instructions: Smart EPD General Program Instructions v.1.0, November 2022

Verification Information

LCA Author/Creator:

Sean Daley — Sphera

info@sphera.com

EPD Program Operator:

Smart EPD — info@smartepd.com

www.smartepd.com — 585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA

Verification:

Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071: External

Lindita Bushi — lindita.bushi@athenasmi.org

Independent external verification of EPD, according to ISO 14025 and reference PCR(s): External

Lindita Bushi — lindita.bushi@athenasmi.org

Limitations, Liability, and Ownership

Comparison of the environmental performance of Building Envelope Thermal Insulation 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. Full conformance with the PCR for Building Envelope Thermal Insulation 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.

Organization Information

The North American Insulation Manufacturers Association (NAIMA) is the association for North American manufacturers of fiberglass, rock wool, and slag wool insulation products. NAIMA promotes energy efficiency and environmental preservation through the use of fiberglass insulation and encourages the safe production and use of these materials.

Further information can be found at:
https://insulationinstitute.org/about-naima/

Product Description

Product Identification

Fiberglass batt insulation is a rigid, bonded blanket insulation produced in a range of R-values (thermal resistance). Fiberglass is inorganic and noncombustible. It is made from molten glass and spun or blown into fibers that are then processed into the final product, available in both faced and unfaced varieties. The fibers will not rot or absorb moisture and do not support the growth of mildew, mold, or fungus.

The following fiberglass batt products are covered by this environmental product declaration:

- Unfaced Fiberglass.

Product Specification

Fiberglass batt insulation is an effective insulation that meets the requirements of ASTM C665 –Fiberglass Batts Thermal Insulation. The batts are installed to insulate floors, walls, ceilings, and attic areas. Batts come with or without facing. The batts can be easily placed and cut, trimmed and shaped to fit small or irregular spaces. The batts are made to be easily installed by pressure fitting between framing, with no fastening required.

Product Information

Functional Unit:	1 m2
Mass:	0.396 kg
Reference Service Life:	75 Years
EPD Type:	✓ Industry Average
	✗ Product Specific

Averaging:

This EPD is intended to represent an industry average for fiberglass batts unfaced. The vertical average is calculated based on the mass of product manufactured by NAIMA member companies. Vertical averaging refers the the process of averaging facility data regardless of production volumes - as in assuming all have equal production volumes. The final results however are presented based on production weighted average so that it is more representative of the flow of materials in the manufacturing process. NAIMA represents the majority of the North American fiberglass industry. Four NAIMA participating member companies have 14 locations in US and Canada. NAIMA covers all North American fiberglass insulation manufacturers, so retroactive participation is not relevant. Therefore, NAIMA prefers not to disclose maximum facility size, utilization rate, or other identifying facility details given the small number of facilities participating in this study. Use of this EPD is limited to NAIMA member companies.

The functional unit being evaluated, as specified by the PCR, is: 1 m2 of insulation material with a thickness that gives an average thermal resistance RSI = 1 m2·K/W (RIP = 5.68 ft2·°F·hr/Btu) and with a building service life of 75 years (including packaging). The reference flow is the mass of material required to provide the above thermal resistance for the product system. The relative masses and thickness of the products are calculated from production volume-weighted averages based on total mass produced by all manufacturers. As all the product is assumed to last the required 75 years of building service life, the masses correspond to 1 m2 of loose fill fiberglass is 0.396 kg having the thickness 1.29 inches. This EPD is intended to represent an industry average for fiberglass unfaced batts. The vertical average is calculated based on the mass of product manufactured by NAIMA member companies. NAIMA represents the majority of the North American fiberglass insulation industry.

Participating Manufacturers

- CertainTeed, Inc. Saint-Gobain
- Johns Manville
- Knauf Insulation North America
- Owens Corning

Product Specifications

Product SKU(s):

Product Classification Codes: Masterformat - 07 21 16

Form Factor: Blown

Insulation type: Fiberglass

Density: 12.01 kg/m3

Thickness for R value of 1: 33 mm

Intended Application: Wall & General, Other

Thermal resistance: 1 m2K/W

List of standards required for the testing, evaluation, and approval of the declared product and its application in building assemblies for building code and other regulation compliance : – ASTM C655 – ASTM E136

EPD Data Specificity

Primary Data Year: 2019

Manufacturing Specificity:

- ✗ Manufacturer Specific
- ✓ Plant Specific
- ✗ Batch Specific

Software and LCI Data Sources

LCA Software: GaBi v. 10.0

LCI Foreground Database(s):

GaBi Professional Database v. 2021.2 — North America

Mass based

LCI Background Database(s):

GaBi Professional Database v. 2021.2 — North America

Mass based

Material Composition

Material/Component Category	Origin	% Mass
Silica Sand	US	24
Limestone	US	1
Soda Ash	US	8
Glass Cullet	EU-28	45
Borate	US	15
Binder	EU-28	7

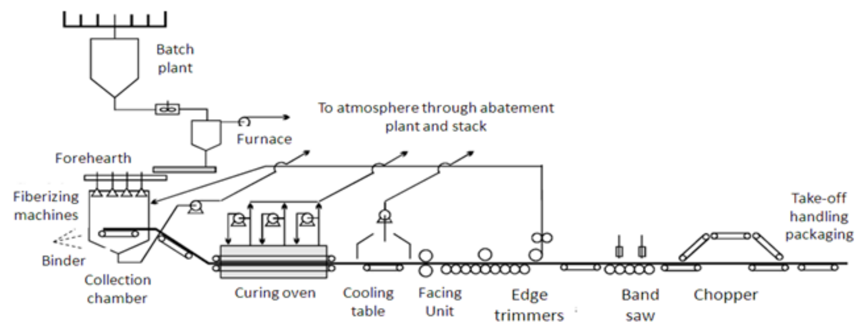
Packaging Material	Origin	kg Mass
Paper	US	9.12E-05
PE	US	1.10E-02
PET	US	3.59E-04
PP	US	6.72E-04
Tape	US	1.81E-05

Hazardous Materials
No regulated hazardous or dangerous substances are included in this product.

System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	✓
	A5	Assembly / Install	✓
Use	B1	Use	ND
	B2	Maintenance	ND
	B3	Repair	ND
	B4	Replacement	ND
	B5	Refurbishment	ND
	B6	Operational Energy Use	ND
	B7	Operational Water Use	ND
End of Life	C1	Deconstruction	✓
	C2	Transport	✓
	C3	Waste Processing	✓
	C4	Disposal	✓
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Product Flow Diagram



Life Cycle Module Descriptions

Fiberglass Batts (Unfaced)

This EPD is declared under a “cradle to gate" system boundary, which includes modules A1-A5 and C1-C4. C1 and C3 are assumed to have no impact because fiberglass batts insulation deconstruction are done manually hand and is not recycled.

Manufacturing

To produce batt insulation, the glass component raw materials are melted and glass is spun into fibers. In general, fiberglass is available as “loose” wool and then a binder is applied to create the batts. The binder component raw materials are mixed up and injected into the process, after which the product with the combined components is cured, sized and then packaged.

The life cycle for fiberglass batts begins with raw material extraction. These batch materials are melted and formed into the end product. At finishing they are cooled and packaged (see flow diagram in Figure). The packaged product is transported to the customer at the construction site where it is installed manually.

Landfill and incineration emissions from paper, plastic, and wood packaging are allocated to installation (module A5). Packaging disposal is included as part of the installation module

Packaging:

The product is typically packaged with plastic wrap, although wire and cardboard separators are occasionally used. Packaging materials are not assumed to be reused. Since no primary data are available, the disposal assumptions provided in Part A (UL Environment, 2018) are used.

Transportation:

Average transportation distances via truck and rail are included for the transport of the raw materials to production facilities. Transport of the finished product 684 miles via truck to the construction site is also accounted for, along with the transport of construction wastes and the deconstructed product at end-of-life to disposal facilities (20 miles via truck). Batts are often compressed when packaging; therefore, distribution of the finished product is assumed to be mass-limited. Additional information is provided in Transport to the building/construction site (A4).

The analysis uses the following assumptions:

– If inbound transportation distances were not provided for materials used in manufacturing, a default assumption of 500 miles (800 km) transport via truck was applied in the model.

Product Installation

Batts and roll insulation are easy to handle and install. Sized for installation in either wood or metal frame construction, unfaced insulation is friction fit into place. Trimming and fabrication can be done with a utility knife and can be cut to fit into odd-shaped cavities and small spaces. 10% material loss is assumed in the study.

Landfill and incineration emissions from paper, plastic, and wood packaging are allocated to installation (module A5). Packaging disposal is included as part of the installation module.

End-of-Life

Fiberglass batts are typically reusable if removed, but the frequency of reuse is not known. Although recycling is feasible, there are minimal recycling programs and infrastructure; therefore, current practice is to send the waste to a landfill. Thus, reuse, recycling, and energy recovery are not applicable for this product.

At the end-of-life, insulation is removed from the deconstructed building. The waste is then transported 20 miles and disposed in a landfill per PCR requirements (UL Environment, 2018).

Fiberglass insulation is assumed to last the lifespan of the building and is only removed upon building demolition. Since the PCR states that the building has a 75-year reference service life, the insulation is assumed to have the same reference service life.

LCA Discussion

Cut-off Criteria:

For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts. Cut-off criteria, however, were applied to exclude capital goods and infrastructure as these are assumed to not significantly affect LCA results nor conclusions.

Allocation:

No co-product allocation occurs in the product foreground system. Allocation was used in the LCA FE MLC (managed LCA content) 2021.2 background data. For further information on a specific product see https://sphera.com/product-sustainability-gabi-data-search/.

The LCA model accounts for the inbound transportation of the glass cullet to A2. For recycled content and disposal at end-of-life, system boundaries were drawn consistent with the cut-off allocation approach. Therefore under a cut-off approach, recycled inputs in the fiberglass production such as cullet are considered burden free, and any avoided burden as a result of recycling at the EOL (material or energy recovered) is not considered.

Data Quality:

A variety of tests and checks were performed throughout the project to ensure high quality of the completed LCA. Checks included a review of project-specific LCA models as well as the background data used.

Geographical Coverage

In order to satisfy cut-off criteria, proxy datasets were used as needed for raw material inputs to address lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their representativeness of the actual product. Additionally, European data or global data were used when North American data (for raw materials sourced in the US) were not available.

Temporal Coverage

Foreground data for each manufacturer represent a continuous 12-months over the 2019 calendar year. The majority of background datasets are based on data from the last 10 years (since 2011).

Results

Environmental Impact Assessment Results

IPCC AR5 GWP 100, TRACI 2.1

per 1 m2.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact Category	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
GWP-total	kg CO2 eq	1.01e+0	7.27e-3	3.57e-2	0	6.72e-3	0	2.30e-2
ODP	kg CFC 11 eq	1.58e-11	1.51e-18	6.62e-18	0	1.40e-18	0	5.98e-17
AP	kg SO2 eq	1.96e-3	1.40e-5	1.11e-4	0	1.29e-5	0	7.75e-5
EP	kg N eq	2.29e-4	2.01e-6	1.94e-5	0	1.85e-6	0	6.48e-6
POCP	kg O3 eq	3.06e-2	3.17e-4	4.49e-4	0	2.93e-4	0	1.36e-3
ADP-fossil	MJ	1.54e+1	1.06e-1	3.96e-2	0	9.84e-2	0	2.69e-1

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Results

Resource Use Indicators

per 1 m2.

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
RPRE	MJ	2.60e+0	4.42e-3	2.90e-3	0	4.09e-3	0	2.28e-2
RPRM	MJ	1.90e-1	0	0	0	0	0	0
NRPRE	MJ	1.68e+1	1.07e-1	4.03e-2	0	9.91e-2	0	2.75e-1
NRPRM	MJ	1.01e+0	0	0	0	0	0	0
SM	kg	1.50e-1	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m3	6.77e-3	1.89e-5	9.35e-6	0	1.75e-5	0	4.68e-5

Results

Waste and Output Flow Indicators

per 1 m2.

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
HWD	kg	7.37e-5	8.96e-12	3.70e-12	0	8.29e-12	0	2.59e-11
NHWD	kg	5.72e-2	9.86e-6	7.88e-2	0	9.11e-6	0	4.06e-1
HLRW	kg or m3	7.52e-7	3.61e-10	3.22e-10	0	3.34e-10	0	2.68e-9
ILLRW	kg	1.37e-5	6.59e-9	5.72e-9	0	6.09e-9	0	4.76e-8
CRU	kg	0	0	0	0	0	0	0
MFR	kg	2.64e-2	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0
EE	MJ, LHV	3.96e-5	0	1.23e-2	0	0	0	1.56e-2

Results

Carbon Emissions and Removals

per 1 m2.

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
BCRP	kg CO2	0	0	0	0	0	0	0
BCEP	kg CO2	0	0	0	0	0	0	0
BCRK	kg CO2	4.31e-5	0	0	0	0	0	0
BCEK	kg CO2	0	0	3.92e-5	0	0	0	0
BCEW	kg CO2	0	0	0	0	0	0	0
CCE	kg CO2	0	0	0	0	0	0	0
CCR	kg CO2	0	0	0	0	0	0	0
CWNR	kg CO2	0	0	0	0	0	0	0

Scenarios

Transport to the building/construction site (A4)

A4 Module

Fuel Type:	Diesel
Liters of Fuel:	0.0012 l/100km
Vehicle Type:	Truck
Transport Distance:	1102.41 km
Capacity Utilization:	78 %
Packaging Mass:	
Gross density of products transported:	12.01 kg/m3
Weight of products transported:	
Volume of products transported:	
Capacity utilization volume factor:	

Installation in to the building/construction site (A5)

A5 Module

Waste Materials at the Construction Site Before Waste Processing:	0.06 kg
Output Materials Resulting from On-site Waste Processing:	0.06 kg

Scenarios

End of Life

C1 - C4 Modules

Collection Process

Collected with Mixed Construction Waste: 0.396 kg

Recovery

Landfill: 0.396 kg

Disposal

Product or Material for Final Disposal: 0.396 kg

Interpretation

LCA Interpretation:

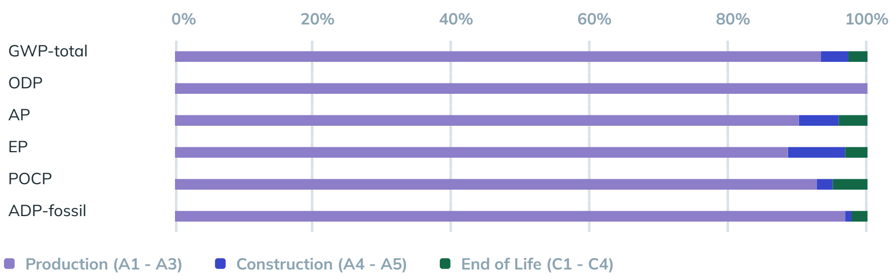
The manufacturing stage dominates the majority of impact categories due to the energy required by the melting and finishing stages. Raw materials are the second largest contributor due to upstream burdens in material extraction. Together, manufacturing (A3) and Raw Materials (A1) represent nearly 90% of impacts. Therefore, these are the two most effective areas for focusing environmental improvements.

While installation (A5) incurs minimal resources, it is the point at which there is 10% product loss and this impact is most noticeable for Eutrophication with a 7% contribution. End of Life disposal (C4) has contributions of 3-4% in acidification, eutrophication and smog formation. Outbound transport is a minor contributor.

There is no impact associated with the use stage. While insulation can influence building energy performance, this aspect is outside the scope of this study. Additionally, it is assumed that insulation does not require any maintenance to achieve its reference service life, which is modeled as being equal to that of the building (i.e., 75 years). No replacements are necessary; therefore, results represent the production of one (1) square meter of insulation at a thickness defined by the PCR functional unit.

At end-of-life, insulation is removed from the building and landfilled. Waste was dominated by the end-of-life disposal of the product. Non-hazardous waste also accounts for waste generated during manufacturing and installation.

Impact assessment and other results are shown for a Cradle to gate, with modules A1-A5 and C1-C4 included system boundary. Modules C1 and C3 are not associated with any impact and are therefore declared as zero.



Additional Environmental Information

Mandatory Environmental Information: Fiberglass batts do not contain substances classified as hazardous waste under the Resource Conservation and Recovery Act (RCRA) (EPA, n.d.). Release of substances from fiberglass to air, soil, or water is not a concern (US DHHS, 2004).

Environment and Health During Manufacturing: The NAIMA Product Stewardship Program's work practices apply to the manufacture, fabrication, installation, removal, and other work settings where workers are subject to exposures to fiberglass fibers. The Product Stewardship Program commits manufacturers to use product design, engineering controls, work practices, respiratory protection or a combination of any or all of these measures to bring fiber exposures to the voluntary one fiber per cubic centimeter permissible exposure limit (1 f/cc PEL).

NAIMA has established an exposure database (Marchant, et al., 2002) (Marchant, et al., 2009) containing existing information about exposure levels categorized by product type and specific work task. The database establishes that manufacturing exposures are well below the voluntary permissible exposure limit (PEL) of 1 f/cc.

Building Use Stage Benefits: Fiber glass batt insulation requires no additional energy or maintenance in order to perform during the life of service. Fiberglass insulation is effective in helping reduce heat flow, reduce unwanted noise, and control moisture.

Environment and Health During Installation: The NAIMA Product Stewardship Program's work practices apply to the installation as well as manufacturing and other occupational settings where workers are subject to exposures to fiberglass fibers. The Product Stewardship Program specifies comprehensive work practices for those working with fiberglass fibers, including recommendations for cost effective engineering controls (when applicable), proper respirator use, use of protective clothing, and workplace guidelines. In locations that require power sawing, routing, sanding, or grinding, or employ other operations that lead to dusty conditions, local exhaust ventilation should be used.

NAIMA has established an exposure database (Marchant, et al., 2002) (Marchant, et al., 2009) containing existing information about exposure levels categorized by product type and specific work task.

According to the "Toxicological Profile for Synthetic Vitreous Fibers" (US DHHS, 2004):

Very low levels of synthetic vitreous fibers can be found in virtually all homes, buildings, and outside air, but there is little concern regarding these low levels... As long as the [SVF] materials are not physically disturbed or breaking down, the levels of synthetic vitreous fibers in the air should be very low.

The overwhelming majority of human exposure to synthetic vitreous fibers occurs as occupational exposure through inhalation and dermal contact. Occupational exposure is estimated to be several orders of magnitude greater than environmental exposure.

The exposure of the general population (non-occupational exposure) to synthetic vitreous fibers in both indoor and outdoor air is low... Furthermore, it has been shown that the airborne levels of synthetic vitreous fibers attenuate rapidly following installation.

Extraordinary Effects: Fire

The performance of building materials in a fire is a key factor in protecting the occupants of the building and allowing them to escape safely. Fiberglass insulation is naturally non-combustible and remains this way for the life of the product without the addition of harsh and potentially dangerous chemical fire retardants.

Due to these properties, fiberglass insulation can be used as passive fire protection in many buildings. Manufacturers of these products encourage a balanced design, which includes a combination of active, detective, and passive fire protection in building codes to ensure the safety of building occupants.

These products should meet NFPA 220 and ASTM E136 standards and test methods and are Class A product tested per ASTM E84 and NFPA 101.

Health Impacts: NAIMA and its member companies are committed to ensuring that fiberglass products can be safely manufactured, installed, and used. NAIMA member companies have funded tens of millions of dollars of research at leading independent laboratories and universities in the United States and abroad. The weight of the scientific research shows no association between exposure to fiberglass fibers and respiratory disease or cancer in humans.

In October 2001, an international expert review by the International Agency for Research on Cancer (IARC) (IARC, 2001) re-evaluated the 1988 IARC assessment of glass fibers and removed glass and fiberglass fibers from its list of substances "possibly carcinogenic to humans." All fiberglass and fiberglass that are commonly used for thermal and acoustical insulation are now considered not classifiable as to carcinogenicity to humans (Group 3). IARC noted specifically:

Epidemiologic studies published during the 15 years since the previous IARC Monographs review of these fibers in 1988 provide no evidence of increased risks of lung cancer or mesothelioma (cancer of the lining of the body cavities) from occupational exposures during manufacture of these materials, and inadequate evidence overall of any cancer risk.

The IARC downgrade is consistent with the conclusion reached by the U.S. National Academy of Sciences, which in 2000 found "no significant association between fiber exposure and lung cancer".

Scientific evidence demonstrates that fiberglass is safe to manufacture, install, and use when recommended work practices are followed. Following these work practices will help to reduce irritation

...

References

ASTM C665-17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and

Manufactured Housing

ASTM E136,Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

ISO. (2006). ISO 14044/Amd1:2017/Amd2:2020: Environmental management - Life cycle assessment - Requirements and guidelines

ISO. (2006). ISO 14040/Amd1:2020: Environmental management - Life cycle assessment - principles and frameworks ISO. (2006). ISO 14025: Environmental labels and declarations - Type III environmental declarations - principles and procedures .

ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services

Sphera. (2023). LCA for Experts Documentation. Retrieved from Sphera: https://sphera.com/life-cycle-assessment-lca-software/.

Sphera Inc. (2023). Environmental Product Declaration (EPD) in accordance with ISO 14025 and ISO 21930:2017, Fiberglass Batts (Unfaced) Insulation. Smart EPD

UL Environment. (2018). Product Category Rules for Building-Related Products and Services - Part A: Life Cycle Assessment Calculation Rules and Report Requirements, v3.1.

UL Environment. (2018). PCR Guidance for Building-Related Products and Services - Part B: Building Envelope Thermal Insulation EPD Requirements