Product Category Rule (PCR) Guidance for Building-Related Products and Services

Part B: Building Envelope Thermal Insulation EPD Requirements

UL 10010-1

https://www.ul.com/services/portfolios/sustainability-and-environment

Product Category Rules (PCR) Guidance for Building-Related Products and Services Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010–1

Edition 4.0, dated August 2024 (date to be updated upon publication)

Summary of Topics

Edition 4.0 of the Product Category Rules (PCR) Guidance for Building-Related Products and Services Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010–1 has been issued.

Publisher:

ULSE Inc.

Tracking of versions:

Version	Comments	History
1.0	UL Solutions with input from a committee	9/12/2011
1.1	Version amended by UL Solutions to allow for industry-average EPDs	8/7/2013
1.2	Version amended by UL Solutions to modify temporal requirements	10/29/13
1.3	Version amended by UL Solutions to include mechanical insulation in Appendix II	7/7/14
2.0	Updated and republished under Part A and Part B format to conform with EN 15804 and ISO 21930:2017; separate PCR created for mechanical insulation	4/10/2018
3.0	PCR Extended for a year while the committee works on updating for republication	4/01/2023
4.0	PCR updated via committee to address x, y, z	x/x/2024 (TBD)

Background Information and Acknowledgements

These sub-category Product Category Rules (PCR) were developed to address the product specific rules for the creation of Environmental Product Declarations (EPD) for building envelope thermal insulation. When used to self-reference this document, “PCR” refers to “sub-category PCR.”

Other PCRs considered in the original development of this PCR include:

- PCR for Insulated Metal Panels, Metal Composite Panels, and Metal Cladding. UL Solutions, *June, 2022*.
- NPCR 012:2022 Part B for thermal insulation products (references to EN 15804 +A2). EPD Norge. March 2022.
- PCR 2019:14-c-PCR-005 c-PCR-005 Thermal Insulation products (EN 16783). Environdec (International EPD. March 2024.
- PCR Guidance-Texts for Building-Related Products and Services, From the range of Environmental Product Declarations of Institute of Construction and Environment e.V. (IBU), *Part B: Requirements for the EPD for Calcium silicate insulating materials, v8, August 2024.*
- PCR Guidance-Texts for Building-Related Products and Services, From the range of Environmental Product Declarations of Institute of Construction and Environment e.V. (IBU), *Part B: Requirements for the EPD for Insulating materials made of foam plastics, v10, August 2024.*
- PCR Guidance-Texts for Building-Related Products and Services, From the range of Environmental Product Declarations of Institute of Construction and Environment e.V. (IBU), *Part B: Requirements for the EPD for Mineral insulating materials ,v8, August 2024.*
- PCR Guidance-Texts for Building-Related Products and Services, From the range of Environmental Product Declarations of Institute of Construction and Environment e.V. (IBU), *Part B: Blow-in*

insulation materials made from cellulose and wood fibres v8. August 2024.
- Product Category Rules for Building Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements. UL Solutions, v4, March 2022
- ISO 21930:2017 - Sustainability in building construction -- Environmental declaration of building products

Life Cycle Assessment reference studies informing the development of this PCR include:

- Spray Polyurethane Foam Insulation Products: EPD Background Report, v1.0. sphera on behalf of Spray Polyurethane Foam Alliance. 2024.
- Expanded Polystyrene Foam Insulation Products, Life Cycle Assessment background report for: Expanded Polystyrene Insulation, v.2.3, Intertek, on behalf of EPS Industry Alliance. 2023.
- Rigid Polyisocyanurate Foam Board Insulation: Life Cycle Assessment of Rigid Polyisocyanurate Foam Board Insulation. Long Trail Sustainability on behalf of Polyisocyanurate Insulation Manufacturers Association (PIMA), August 2020.
- Life Cycle Assessment (LCA) of CIMA Loosefill Cellulose Insulation Products, Sustainable Minds on behalf of Cellulose Insulation Manufacturers Association. November 2019.
- Life Cycle Assessment of Mineral Wool Insulation Products Background Report in Support of Environmental Product Declarations. TrueNorth Collective, LLC, on behalf of the North American Insulation Manufacturers Association. November, 2023
- Life Cycle Assessment of Fiberglass Insulation Products EPD Background, v1.0. sphera, on behalf of the North American Insulation Manufacturers Association. March 2023.

Interested Parties

This Part B has been prepared with input from the following stakeholders:

- American Chemistry Council (ACC)
- Carbon Leadership Forum (CLF)
- Center for the Polyurethanes Industry (CPI) Spray Foam Coalition
- CertainTeed/Saint-Gobain North America
- Cellulose Insulation Manufacturers Association (CIMA)
- Covestro LLC
- EPS Industry Alliance (EPS-IA)
- Extruded Polystyrene Foam Association (XPSA)
- Knauf Insulation
- North American Insulation Manufacturers Association (NAIMA)
- Nu-Wool
- Nicholson Consulting
- Owens Corning
- Polyisocyanurate Insulation Manufacturers Association (PIMA)
- Spray Polyurethane Foam Alliance (SPFA)
- US Environmental Protection Agency (EPA)

Governance

There are a number of trade associations and representatives of insulation manufacturers participating in the update of this Product Category Rule (“PCR”) for thermal insulation. These parties represent all or a majority of the companies in their particular sector of the insulation industry. Moreover, the parties participating in the PCR update represent the vast majority of insulation types produced in North America. The very purpose and function of a trade association is to inform its members of important industry developments and to represent their interests in projects such as the update of a PCR affecting their products. This is important because it effectively demonstrates that a large percentage of the thermal insulation industry is represented in the effort to renew the PCR for insulation products.

The role of participants is to establish requirements and procedures to be applied in the development of EPDs for thermal insulation. This is an update to an existing PCR, and therefore, this effort begins with the vetting of required changes in scope and structure. A fundamental aspect of the utility of the LCA tool is demonstration of reduction of a product’s environmental impact, so maintaining applicability of EPDs certified under the existing PCR is a critical consideration for participants. In the development of this document, Part B, participants are responsible for ensuring alignment with Part A and conformance with the scoped standards: EN 15804, ISO 21930, and ISO 14025.

Involvement of Interested Parties

"The Program Operator [UL Solutions] shall be responsible for producing the PCR document by establishing an open consultation process that includes the involvement of interested parties (ISO 21930 Section 5.2 and 6.2.1). "Reasonable efforts should be made to achieve a consensus throughout the process" (ISO 14020:2000, 4.9.1, Principle 8 and cited in both ISO 14025 and ISO 21930). The Program Operator shall establish procedures for determination of consensus. Consensus is demonstrated by a vote of participating interested parties.

Insulation trade associations informed their memberships of the insulation PCR update through their regularly scheduled association and association committee meetings, newsletters, e-mail messages, and similar types of outreach. Trade associations operate at the behest of its members, and the fact that trade associations are participating in the update of a PCR for insulation products is an indication that their memberships are aware of this project and have authorized their association to represent them in this important endeavor.

UL Solutions invited interested parties to comment on version 3 of the PCR from January 17 – April 10, 2023 via its standards website, social media outlets, and outreach to original committee stakeholders.

Update Process

The PCR shall be revised five (5) years from the publication date. The PCR shall be revised before the five year date if the following occurs in the industry: major regulatory change that alters the requirements for R-value definition so significantly the definition of R-value, thickness, or RSL in this PCR is no longer accurate; major shift in the markets such that a new material or system predominates that can no longer be characterized adequately by the definition of R-value, thickness, or RSL in this PCR.

As part of the 2023 update process, UL Solutions communicated with all original committee members listed in the publication of v2.

Review

The review process of this Part B PCR included a review through two public consultations in January 17 – April 10, 2023 and October xx- December xx, 2024 in addition to an independent panel review.

This Part B was reviewed by the following panel who assessed the PCR for conformance with the UL Part A and ISO 21930: (To be updated following new panel review conducted after public comment period)

Thomas Gloria, PhD (chair) Industrial Ecology Consultants
t.gloria@industrial-ecology.com

Christoph Koffler, PhD
thinkstep
christoph.koffler@thinkstep.com

Andre Desjarlais
Oak Ridge National Laboratory
desjarlaisa@ornl.gov

Public Consultation

Public consultation was utilized during the PCR review process. The public consultation of the completed draft PCR included a minimum 30-calendar-day period for comments to be submitted to UL Solutions. After public comments were submitted, the PCR committee reviewed and developed responses for all comments. All comments from the review panel and public consultation were addressed and satisfactorily resolved by the PCR committee prior to the publication of this PCR.

Scope

This document contains the Product Category Rule (PCR) requirements for a Building Envelope Thermal Insulation Environmental Product Declaration (EPD) published in accordance with the EN 15804+A2 and ISO 21930 standards. The requirements for the background Life Cycle Assessment (LCA) project report used to inform the EPD are contained in UL Solutions' UL Part A. This Part B document, coupled with the Part A, conforms to the EN 15804, ISO 21930, and ISO 14025 European and international standards for EPD reporting.

General Guidance

The scope of this PCR applies to the product group "building envelope thermal insulation" and includes all commercially available building envelope thermal insulation products according to the standards or technical approvals shown under Section 9, regardless of material type, including but not limited to: mineral fiber insulation (rock, slag or glass), cellulose-based insulation, polymer-based insulation, cellular glass, and textile-based insulation.

Thermal insulation is an important technology to reduce energy consumption in buildings by preventing heat gain/loss through the building envelope. Thermal insulation is a construction material with low thermal conductivity and the purpose of these materials is to save energy, protect and provide comfort to occupants. Of the many forms, shapes and applications of thermal insulation, this PCR applies to insulation installed in building envelopes– i.e., basements, slab on grade, elevated cantilevered slabs, fenestration framing, walls, floors, ceilings, parapets, roof curbs, attics, and roofs.

Note: There is a separate sub-category PCR for mechanical insulation that shall be used when creating EPDs for piping, HVAC and other mechanical and technical insulation products.

Applicable Products

The following Construction Specification Institute (CSI) Masterformat codes cover the scope of this Part B:

- 07 21 00 - Thermal Insulation
  - 07 21 13 Board Insulation
  - 07 21 13.13 Foam Board Insulation
  - 07 21 13.16 Fibrous Board Insulation
  - 07 21 13.19 Mineral Board Insulation
  - 07 21 16 Batt and Blanket Insulation
  - 07 21 19 Foamed-In-Place Insulation
  - 07 21 19.13 Aminoplast Foam Insulation
  - 07 21 19.16 Polyurethane Foam Insulation
  - 07 21 23 Loose-Fill Insulation
  - 07 21 26 Blown Insulation
  - 07 21 29 Sprayed Insulation
- 07 22 00 - Roof and Deck Insulation
  - 07 22 16 Roof Board Insulation

It should be noted that this PCR may also apply to the thermal insulation components of the assemblies and categories listed below. PCRs developed for the assemblies and categories listed below should cross-reference and harmonize with this PCR.

- Insulated Sectional Chimneys (CSI 23 51 33)
- Insulated Concrete Masonry Units (CSI 04 22 23)
- Structural Insulated Panels (SIPs) (CSI 06 12 00)
- Exterior Insulation and Finish Systems (EIFS) (CSI 07 24 00)
- Insulated Concrete Forms (ICFs) (CSI 03 11 19)
- Insulated Doors, including Garage Doors (CSI 08 34 50, 08 13 00, 08 14 00, 08 15 00, 08 16 00*, non-exhaustive*)
- Other Composite Insulation Board Products (CSI 06 16 00)

Non-Applicable Products

- Mechanical insulation (Covered under the Product Category Rules for Part B: Mechanical, Specialty, Thermal, and Acoustic Insulation Product EPD Requirements. UL Solutions 10010-3, v1. Sept 2019.)
- Insulated metal [wall] panels (IMPs) (CSI 07 42 13 19). (Covered under the Product Category Rules for Part B: Insulated Metal Panels, Metal Composite Panels, and Metal Cladding: Roof and Wall Panels. UL Solutions 10010-5, v2. October 2018.)
- Reflective Insulation and radiant barrier materials or coatings that rely on air space and/or emissivity for their thermal claims (CSI 07 21 53)
- Roof Cover Protection Board PCR Part B (Covered under Product Category Rules Part B: Roof Cover Protection Board EPD Requirements. UL Solutions 10010-36, v.1, November 2021).

Geography

This PCR applies to products sold and used in North American markets but may be manufactured within other geographies.

System Boundary

The system boundary for EPDs created using this PCR is cradle to grave. The EPD requirements include:

- Requirements of the UL General Program Instructions (available upon request)
- The calculation rules for the Life Cycle Assessment and Requirements on the Project Report are specified in a separate document as Part A of the Product Category Rules, available at https://www.ul.com/resources/product-category-rules-pcrs. When creating an EPD using this Part B PCR, the most current version of the Part A shall be referenced.

Industry-Average EPD and Report Requirements

Industry-Average EPD Scope

The scope of products represented within a single industry-average EPD created using this PCR is limited to the primary material defined in the standards in Section 9 that characterize the product in commerce.

Involvement of Interested Parties

A call for involvement of interested parties in the creation of an industry-average EPD shall be published in at least one industry trade publication. At a minimum, at least three (3) different manufacturing locations from no less than two (2) companies should be involved and represented in an industry-average EPD. The method for determining representativeness shall be justified and described per the requirements listed in Section 2.2.4.1.

Industry-Average EPD Participation

A manufacturer qualifies for participation in an industry-average EPD created using this PCR if they provide primary manufacturing data used in calculating the initial EPD average or demonstrates willingness to provide primary manufacturing data during the LCA data collection process.

Retroactive Participation

A manufacturer may apply for retroactive participation by providing relevant qualitative and quantitative manufacturing and product information to the Program Operator, as detailed below. The Program Operator will assess representativeness and will inform and provide the original industry-average EPD committee with this application. The participation decision ultimately resides with the Program Operator. A manufacturer desiring retroactive inclusion in the industry-average EPD should provide the following representative manufacturing and product data information to the Program Operator for the reference year declared: 1) main process energy fuel source(s), if generated on-site; 2) applicable emission thresholds and permits; 3) main raw materials, including bill of materials with corresponding masses; 4) facility output and utilization rate(s); 5) involved manufacturing process(es); and 6) reported R value. All reported data shall be normalized by functional unit. If any of the reported data is greater than the maximum value in the range of normalized product inventory data in the background report, the manufacturer shall not claim representation by the existing industry average. The Program Operator shall refer to the background report for the industry average to assess whether the provided information meet this criterion.

In case of industry-average EPDs, the background report shall contain the following information as the basis for evaluating retroactive participation[1]:

- Minimum and Maximum facility production volumes included in the sample,
- Minimum and Maximum production energy intensity per functional unit in the sample,
- Minimum and Maximum utilization rate included in the sample,
- Minimum and Maximum R value included in the sample

When determining a manufacturer's participation eligibility, the EPD Program Operator shall follow the recommendations of the manufacturer and/or its consultants unless the Program Operator has data or information to the contrary, in which case the Program Operator and manufacturer shall confer in an effort to reach consensus.

All manufacturers who submit an application for retroactive participation should participate in the update process when the existing industry-average EPD expires.

Industry Average EPD Use

A manufacturer shall not make claims based on an industry average EPD which leads the market to believe the industry average is representative of manufacturer-specific or product-specific results.

Manufacturers seeking to publicly benchmark product-specific type III EPDs against the industry-average EPD shall have participated in the industry-average EPD process or retroactively via the options outlined above. Manufacturers shall not benchmark using industry average EPDs unless they participated in or qualify for retroactive participation in the industry average EPD.

[1] Note there are additional requirements for reporting of statistical information for industry average EPDs in Section 2.6.

Governance

An industry organization, such as a trade association, shall inform all eligible industry participants through association meetings, newsletters, e-mail messages, and similar types of outreach, including public notices in the trade press publications. Confidential business information shall be collected by a third party. Data from the third party shall be aggregated with no trace to the original source of data.

The development of an industry-average EPD and/or update of such an EPD should involve a series of meetings and exchanges in which all participants are invited and kept apprised of the developments. Advance notices as well as the minutes of these meetings shall be shared with all eligible participants regardless of whether they actively participate. These notices and meeting minutes should be preserved as documentation of the process and due diligence observed in the creation or renewal of the EPD.

Data Responsibility/Ownership

Trade associations that lead the development of industry-average EPDs may need to collect confidential business information from individual member companies. This data can include proprietary chemical formulations and processes or other confidential information. In this case, a designated third-party entity such as an LCA practitioner may be commissioned as the “industry agent”. The industry agent shall be responsible for activities including collection, secure storage and analysis of such data needed for the EPD development and will preserve the privacy of individual company information while executing these duties.

Refer to ISO 21930 Section 5.4 for ownership and development responsibilities of the EPD.

The group of manufacturers responsible for developing an industry-average EPD shall be responsible for, including but not limited to, insuring industry-average EPD updates are made based on the most recent LCA modeling software version and impact assessment version available.

Industry-Average EPD Updates

An update to the existing EPD, or new EPD, may need to be developed at the discretion of the EPD owner prior to the five validity period years if there are: 1) significant changes in the manufacturing process; 2) new industry participants; 3) significant changes or alterations in raw materials; 4) major regulatory changes that mandate or trigger changes to operational procedures; or 5) major technological changes would also justify creation of an updated EPD.

Additional companies may be added to an existing industry-average EPD at the scheduled review by submitting data and having the industry average impacts recalculated.

1. General Information

The following general information shall be declared.

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	Program Operator Provided
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	Program Operator Provided
EPD OWNER NAME AND ADDRESS	
DECLARATION NUMBER	Program Operator Provided
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	
REFERENCE PCR AND VERSION NUMBER	
DESCRIPTION OF PRODUCT'S INTENDED APPLICATION AND USE (AS IDENTIFIED WHEN DETERMINING PRODUCT RSL)	
PRODUCT RSL DESCRIPTION (IF APPL.)	
MARKETS OF APPLICABILITY	
DATE OF ISSUE	Program Operator Provided
PERIOD OF VALIDITY	5 years
EPD TYPE	[Industry-average, product-specific, with additional optional designation as facility-specific]
RANGE OF DATASET VARIABILITY	[Industry-average only; mean, median, standard deviation]
EPD SCOPE	[Cradle to grave]
YEAR(S) OF REPORTED MANUFACTURER PRIMARY DATA	
LCA SOFTWARE & VERSION NUMBER	
LCI DATABASE(S) & VERSION NUMBER	
LCIA METHODOLOGY & VERSION NUMBER	
The sub-category PCR review was conducted by:	Program Operator Provided Program Operator Provided Program Operator Provided
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Solutions "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," (February 2018), based on CEN Norm EN 15804 (2012) and ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Solutions Part A Enhancement (2017) ☐ INTERNAL ☐ EXTERNAL	 Program Operator Provided
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	 Program Operator Provided
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	 Program Operator Provided
LIMITATIONS Environmental declarations from different programs (ISO 14025) may not be comparable. 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. Caution must be used when comparing EPDs, as variations and deviations are possible from e.g. Different LCA software and background LCI datasets that may lead to differences in calculated and reported results.	

2. EPD Content

2.1. Description of EPD Owner

Industry average EPDs shall designate the industry organization (such as trade association that led the EPD project) as the EPD owner and include a list of participating manufacturers and their addresses. The manufacturer of the product(s) covered by a product-specific EPD shall be designated as the EPD owner.

The name of the manufacturing entity(ies) as well as the place(s) of production shall be provided. General information about the manufacturing entity(ies) may be provided, such as the existence of quality systems or environmental management systems, according to ISO 14001 or any other environmental management system in place.

2.2. Product Description

A narrative description of the product shall be provided that enables clear identification of the product. This description shall include information from Section 2.3 and 2.4.

2.3. Product Identification

The declared products shall be identified by brand name(s), by material type(s), by production code(s) (if applicable), and by simple visual representation, which may be by photograph or graphic illustration.

2.4. Product Specification

Related products grouped and reported as an average product in the same EPD satisfying the variation criteria of Part A, Section 5 shall constitute an individual declared product. For each declared product, list the physical characteristics required in Section 3.1 formulas – in the form that the product would be installed or sprayed and cured – along with the reference to the test standard for each. If pertinent, provide a description of the insulation facer. Mass, and therefore density, shall be based on the total amount of material needed to produce 1 m^2 of the given product at a thickness providing an average RSI = 1 m^2K/W, i.e. prior to yield losses, including any facing and ancillary materials. Other relevant product specification values may be provided here, e.g. acoustic performance.

The appropriate ASTM or ULC product specification shall be provided, including additional pertinent physical properties and technical information.

Table 1 through Table 5 provide common subcategories of each type of insulation covered under the scope of this PCR based on application and/or material. An EPD may provide an average across a product family on the basis of these applications and subcategories.

Table 1. Spray Foam Applications and Subcategories

Reference Standards:		ASTM C1029, CAN-ULC S705.1, CAN-ULC S712.1	
		Note: there is no ASTM standard for Low-Density Open-Cell	
Application/ Subcategory	**Insulation**	Low Density Open Cell	CAN-ULC S712.1
		Medium Density Closed Cell	ASTM C1029 Type I
			ASTM C1029 Type II, CAN-ULC S705.1
	Roofing	ASTM C1029 Type III	
		ASTM C1029 Type IV	

Table 2. Polyisocyanurate (Polyiso) Applications and Subcategories

Reference Standards:		ASTM C1289, CAN/ULC-S704.1 Note: Applies to rigid polysio, but does not cover IMPs. CAN/ULC S704.1 specifies product types that can be mapped to ASTM product types	
Application/ Subcategory	**Wall**	Aluminum Foil Facer (AFF)	Type I Class 1
			Type I Class 2
		Coated Glass Facer (CGF)	Type II Class 2
	Roofing	Glass Reinforced Facer (GRF)	Type II Class 1
		Coated Glass Facer (CGF):	Type II Class 2

Table 3. Polystyrene Subcategories

Reference Standards:		ASTM C578, CAN/ULC S701.1 Note: CAN/ULC S701.1 specifies product types that can be mapped to ASTM product types
Application/ Subcategory	**EPS**	Type I
		Type VIII
		Type II
		Type IX
		Type XI
		Type XIV
		Type XV
	XPS	Type IV
		Type V
		Type VI
		Type VII
		Type X
		Type XII
	Additional Classification:	Faced
		Non-faced

Table 4. Mineral Wool and Fiberglass Subcategories

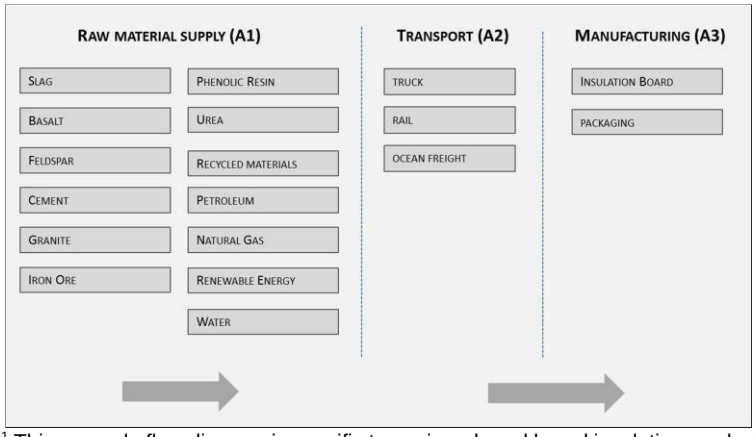
Reference Standards:		ASTM C665, ASTM C764, CAN/ULC S702.1
Application/ Subcategory	**Mineral Wool**	Loose fill
		Heavy density board
		Light density board
		Additional classification:
		Faced
		Non-faced
	Fiberglass	Loose Fill
		Batt Unfaced
		Batt Faced
		Heavy Density Board
		Light Density Board

Table 5. Cellulose Subcategories

Reference Standards:		ASTM C739, CAN/ULC-S703
Application/ Subcategory	**Loose-fill**	e.g. Attic insulation; blown in place or manual installation, lower density
	Dense-pack	e.g. Wall cavity insulation; blown in place behind netting or membrane, higher density
	Additional Classification:	Wall-spray / Stabilized (e.g. wall cavity insulation; blown in place before wall is closed using water or adhesive); cellulosic batt insulation; wood fiber-based insulation; natural fiber-based insulation;

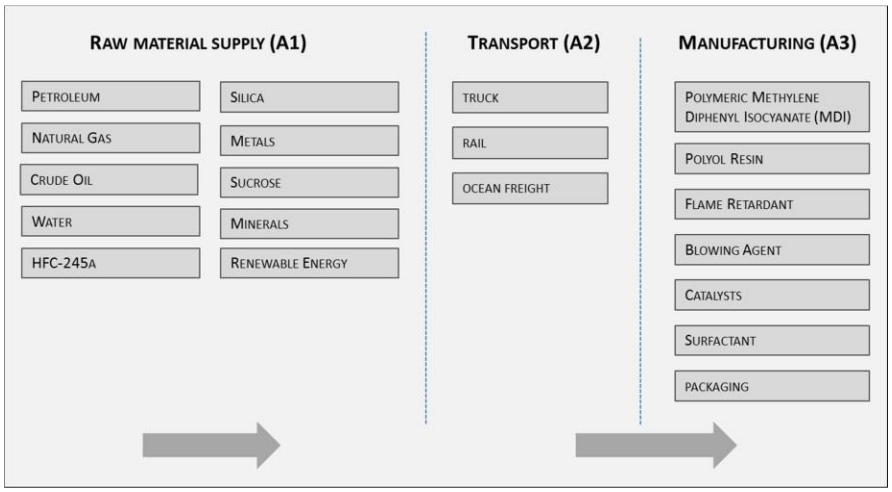
2.5. Flow Diagram[1]

A graphical depiction of a flow diagram illustrating main production processes according to the scope of the declaration shall be included such as the examples in Figure 1 and Figure 2.



[1] This example flow diagram is specific to a mineral wool board insulation product and other product types covered in this PCR will differ.

Figure 1. Example Product Flow Diagram – Spray Polyurethane Foam



2.6. Industry-Average EPD (if relevant)

The method for creating an industry-average EPD shall be described per UL Part A, Section 2.5.1.

Industry-average EPDs shall report, at a minimum, the following statistical information:

- Sample size (number of participating plants)
- Standard deviation of declared A1-A3 environmental impact results, resource flows, and waste flows described in Sections 4.1, 4.7, and 4.8 of the UL Part A. The standard deviation shall be calculated on the basis of individual plants or other statistical methods, such as Monte Carlo Uncertainty Analysis based on [min max] range date, and include weighted mean, standard deviation, and sample size (number of facilities and/or supply chain scenario combinations represented in the statistics)

2.7. Product Specific EPD

The method for creating a company-specific individual product/product family EPD shall be described, including the method for determining a weighted average across products based on production volume as described in UL Part A, Section 2.5.2. Note that the basis for averaging and grouping in a product family EPD shall use the subcategories presented in Section 2.4.

Product-specific EPDs that report results averaged across multiple facilities for one manufacturer shall report statistical information in the LCA project report for all A1-A3 environmental impact results, resource flows, and waste flows described in Sections 4.1, 4.7, and 4.8 of the UL Part A. The statistical information shall be calculated on the basis of individual plants or other statistical methods such as Monte Carlo Uncertainty Analysis based on [min max] range date, and include weighted mean, standard deviation, and sample size (number of facilities and/or supply chain scenario combinations represented in the statistics). This information is not required in the EPD but is encouraged.

Facility Specific EPD

A manufacturer may optionally designate if the reported results in an EPD are representative of a single production facility.

2.8. Application

The designated applications for the referenced product(s) shall be specified. The applications of the declared product(s) shall be described (e.g. above-deck roof insulation, attic insulation, cavity wall insulation, foundation insulation, basement insulation, and interior or exterior continuous insulation).

2.9. Declaration of Methodological Framework

The following items shall be specified: the type of EPD with respect to life cycle stages, (i.e. cradle-to-grave with modules A1-A3, A4, A5, B1-B7, and C1-C4 included).

The reference conditions for achieving the declared technical and functional performance and the Reference Service Life (RSL) shall be included, per UL Part A, Section 2.8.2.

The allocation procedures and cut-off procedure shall be described. Include the statement “no known flows are deliberately excluded from this EPD.”

2.10. Technical Requirements

A listing of all standards required for the specification of the declared product shall be provided. A listing of all standards required for the testing, evaluation, and approval of the declared product, its application in building assemblies for building code, and other regulation compliance shall also be provided and quoted as shown in Section 9.

Note: There is a separate sub-category PCR for mechanical insulation that shall be used when creating EPDs for piping, HVAC and other mechanical and technical insulation products.

References shall be provided to final evaluation reports / certifications / registrations for product-specific EPDs.

2.11. Material Composition

The material composition of insulation products shall be disclosed and will include components as percentages or ranges of percentages of total mass .

Statements of material non-inclusion, such as “… is free of …” shall not be used.

Regulated Hazardous substances and dangerous substances shall be reported per UL Part A, Section 4.11 per ISO 21930, Section 9.2.
Note: This disclosure is intended to enable the user of the EPD to understand the composition of the product in delivery condition and support a safe and effective installation, use and disposal of the product. With appropriate justification, this requirement does not apply to confidential or proprietary information relating to materials and substances that apply due to a competitive business environment or covered by intellectual property rights or similar legal restrictions.

2.12. Manufacturing

The manufacturing process and locations shall be described and illustrated using a simple flow-chart. If the EPD applies to several locations, the production processes for all locations shall be described and reference to quality management systems may be included.

2.13. Packaging

Packaging is excluded from the scope of this PCR.

2.14. Transportation

The following information should be provided to specify any transport after the manufacturing gate: type of transport, type of vehicle, distance, type and amount of energy carrier. Additional transportation scenario assumptions shall be reported in **Error! Reference source not found.**.

2.15. Product Installation

A description of the type of processing, machinery, tools, dust extraction equipment, ancillary materials, etc. to be used during installation and measures for reducing noise shall be included. Information on industrial and environmental protection may be included in this section.

Any waste treatment included within the system boundary of installation waste should be specified. Note that packaging, and therefore packaging waste, is excluded from the system boundary.

Scenario assumptions for installation shall be reported as in Table 10.

2.16. Use

A description of the impacts associated with the use of insulation products shall be included here. Blowing agent emissions (for applicable product types) during the use phase shall be reported in module B1. With the exception of insulation used in roofing applications, impacts for modules B2 – B7 shall be reported as zero (0) impact for all environmental indicators and inventory metrics. Insulation used in roofing applications shall report impacts for replacement in module B4.

Insulation containing captive blowing agents shall report blowing agent emissions during module B1 as detailed in Section 3.11, table 7.

For optional reporting of energy savings during the use of all insulation products, refer to Section 7.2.

All quantitative information related to this section shall be reported in Section 4 “Scenarios and additional technical information”.

2.17. Reference Service Life (RSL) and Estimated Building Service Life

Per Section 2.8.2 of the UL Part A, with the following clarifications:

- With the exception of roofing applications, the reference service life of all insulation products shall be assumed as equal to the estimated building service life.
- Roofing applications shall assume an RSL of 40 years. The RSL for nail-base roof insulation products shall be assumed as equal to the estimated building service life.

The assumptions upon which the designated RSL is based and for which the RSL exclusively applies shall be provided in the Section 4, Table 10. Influences on ageing, when applied, shall be in accordance with the state of the art.

2.18. Re-use Phase

The possibilities of re-use, recycling and energy recovery may be described, although these disposal pathways are not included under the scope of this Part B.

2.19. Disposal

Per the UL Part A, Section 2.8.5 and 2.8.6 with the following clarification:

- In the absence of primary data or evidence of a recycling or manufacturer take-back program, all insulation material shall be assumed to be disposed of via landfill
- Scenario assumptions shall be reported in Table 12.

3. LCA Calculation Rules

3.1. Functional Unit

The functional unit for building envelope thermal insulation is based on the thermal property (design) as determined by the relevant standards/methods for an insulation type (see Section 2.4). Where there is an applicable material specification (i.e. ASTM, CAN/ULC), that standard shall be referenced.

The functional unit for thermal insulation is:

- 1 m² of installed insulation material with a thickness that gives an average thermal resistance RSI = 1 m²K/W and with a building service life of 75 years (packaging excluded).
- The R-value is the manufacturer's representative value for the service life of the material and is determined by the applicable ASTM or CAN/ULC standard, whichever is applicable. The unit for the functional unit mass is kg. The unit for the functional unit service life is years. The defined reference service life of a product shall be verifiable against manufacturer's stated specifications or publicly available information.

Functional units may be expressed as: $FU = RSI \cdot \lambda \cdot \rho \cdot A$ [kg] where,

- RSI = thermal resistance [m²K/W]
- λ = thermal conductivity [W/mK]
- ρ = density of insulation product [kg/m³]
- A = Area [m²] (here, 1 m²)

The EPD shall provide guidance on the determination of results for RSI values other than 1 m²K/WThe thermal resistance may be expressed as: RSI = d/λ where d [m] is the thickness of the insulation. This PCR applies to a wide variety of thermal insulation types, each with its own applicable standard. Some insulation types are offered in different densities that will directly impact R-value. In turn, other insulation types have R-values that are linear with respect to thickness, while others are non-linear. Therefore, since this PCR is based on an R-value functional unit, adjustments for density and thicknesses are to be provided.

The functional unit, mass, and thickness to achieve the functional unit shall be indicated as in Table 6 in the EPD.

Table 6. Functional Unit Properties

Name	Value	Unit
Functional unit	1 m² of insulation material, excluding packaging, with a thickness that gives an average thermal resistance of RSI = 1 m²K/W	
Mass		kg
Thickness to achieve Functional Unit		m

3.2. System Boundary

The type of EPD shall be specified as cradle to grave. The modules considered in the LCA shall be described in brief as per "System boundaries" outlined in Section 2.8 of Part A. It should be apparent as to what processes are considered in what modules per the module descriptions in Section 2.8 of Part A. Any relevant aspects or impacts not included in an information module shall be supported with relevant additional environmental information and the omissions shall be justified.

As detailed in Section 2.16, use phase impacts shall be assumed as zero (0) for modules B2-B7 for all insulation product applications with the exception of roofing applications, which shall report impacts for module B4, replacement.

Capital goods and infrastructure flows shall be excluded from unit processes used to model the LCIA . If available, the LCA report may specify lifetimes of capital goods and infrastructure included.

3.3. Estimates and Assumptions

Key assumptions and estimates for interpretation of the Life Cycle Assessment should be referred to here, provided that they are not dealt with in Section 3 “LCA: Calculation rules”.

3.4. Units

No requirements beyond UL Part A.

Optional Imperial Reporting Units applicable to this Part B:

Functional Unit FU = DU = $R \cdot \lambda \cdot \rho \cdot A$ [lb]
where;

- R = thermal resistance [ft²·°F·hr/Btu]
- λ = thermal conductivity [Btu-in./hr· ft² ·°F]
- ρ = density of insulation product [lb/ft³]
- A = Area [ft²], here 1 ft²

Note: Common units for thermal conductivity in the U.S. are Btu-in./hr·ft²·°F.

3.5. Cut-off Rules

No requirements beyond UL Part A.

3.6. Data Sources

Data sources shall be documented per UL Part A with the following additional requirements:

- EPDs that use secondary data for any unit process that contributes 30% or more to any disclosed environmental impact category shall disclose the data source (database name and version, dataset name, dataset geography, and dataset allocation method). If modifications are made to those datasets contributing 30% or more, the LCA and EPD should state what modifications were made.
- In the absence of primary data, product-specific LCAs and EPDs shall use data from the most recent published industry average EPD for scenario technical information in modules A4, A5, B1 (if relevant), B4 (if relevant), and C1-C4.

3.7. Electricity

In addition to the requirements and guidance for electricity provided in the UL Part A, this Part B PCR allows for the inclusion of on-site and off-site renewable electricity. Specifically,

- If a facility is using on-site renewable electricity, and no Energy Attribute Certificates (EACs) have been sold to a third party, the life cycle data for that renewable electricity shall be used for that product
- Energy Attribute Certificates (EACs) (e.g. RECs, PPAs, GOs) may be included in the main impact LCA assessment results of an LCA project report and EPD and shall conform with the calculation methodology and reporting requirements in the ACLCA “Guidance for Quantifying Renewable Electricity Instruments in Environmental Product Declarations”[2]. A manufacturer must demonstrate a claim to and ownership of the EACs and cannot sell or transfer any instrument used within an EPD for which the manufacturer has already made a claim against that instrument under the EPD. All energy attributes shall be retired and taken out of circulation by the manufacturer after being applied to an EPD.
- If EACs are included in the EPD’s reported life cycle impacts, details of the renewable electricity shall be included in the following:
  - In the EPD
  - In the LCA project report, as outlined in the ACLCA “Guidance for Quantifying Renewable Electricity Instruments in Environmental Product Declarations” requirements. This includes provision of a contractual instrument balance table or equivalent information as well as additional renewable electricity details.

3.8. Biogenic Carbon

Accounting for the uptake and release of biogenic carbon throughout the product life cycle shall follow the UL Part A, Section 4.2, and Section 7.2.7 of ISO 21930:2017. The ACLCA ISO 21930 Guidance[3] document

[2] Aligns with ISO 14067:2018, Section 6.4.9.4.2. See additional requirements in the ACLCA PCR Open Standard v1.0 | Guidance for Quantifying Renewable Electricity Instruments in EPDs, May 26, 2023.
[3] https://aclca.org/aclca-iso-21930-guidance/

provides instructions for further biogenic carbon calculation and is further clarified by the following:

1. Product biogenic CO2 emissions should be declared.
2. Wood and wood-derived materials, relevant to the products under evaluation, are subject to the sustainably managed forest requirement presented in ISO 21930:2017, clause 7.2.7.
3. LCAs that do use biogenic carbon sources in underlying calculations shall report the background LCI dataset used in the EPD.
4. The EPA WARM model shall be referenced for decomposition rates and landfill gas capture rates of main bio-based product materials.

3.9. Data Quality

Per UL Part A Section 3.1.1, with the following clarifications:

- Primary or foreground data should be no more than three years old
- The most recently published and implemented version of available LCI background datasets should be used in the project report. Acceptable deviations include lack of implementation in LCA software, and concurrent LCA work with previously published LCI datasets.

3.10. Period Under Review

The period under review and ensuing averages shall be documented.

3.11. Allocation

Part A, Section 3.3 shall be used as the basis for allocation decisions, and mass should be used as the primary basis for co-product allocation in this Part B. Allocation methods deemed more appropriate than on the basis of mass may be used but only when accompanied by documented justification. The allocations of relevance for calculation (appropriation of releases by module for the applicable products) shall include, at minimum, the following:

- Allocation in the use of recycled and/or secondary raw materials
- Allocation of energy, ancillary and operating materials used for manufacture specific products shall be made to the module(s) in which the allocations are performed
- Allocation of blowing agent releases by module for insulation types containing a captive blowing agent or manufactured with a physical blowing agent (such as, but not limited to, extruded polystyrene (XPS), expanded polystyrene (EPS), polyisocyanurate (polyiso), and spray polyurethane foam (SPF) insulations) shall be in accordance with Table 7. An alternative allocation of blowing agent release by module may be used when accompanied by documented justification that includes supporting data, testing, or research.
- Total blowing agent allocation by module, including any percentage of blowing agent that is expected to remain in the material beyond the 100-year life of the landfill, shall total 100 percent.

Table 7. Blowing Agent Emission Allocation Factors per Information Module

Insulation Category	Manufacturing (A3)	Installation (A5)	Use Phase (B1)	Disposal (C4)	Remains in Material
Extruded Polystyrene	25%	0%	19%	56%	0%
Expanded Polystyrene	94%	6%	0%	0%	0%
Spray Foam	2%	15%	23%	60%	0%
Polyiso	6%	1%	20%	73%	0%

Notes on Table 7:
This table reflects general assumptions based on currently available information, data, and experience, and is intended to create a more complete and consistent reporting of expected blowing agent releases by module and product type. Manufacturers may use alternate allocations based on data from new technologies or recycling programs as they become available.

1. The rate of release during the Use Phase (module B1) and Disposal (module C4) stages is not linear. This non-linearity does not affect the reported results from the LCA model and shall not be adjusted for further interpretation.
2. Blowing agent emissions occur during the deconstruction/dismantling module C1 but are all assigned to module C4 (disposal of waste) in this PCR.

3. Extruded Polystyrene allocations are based on EPA's Greenhouse Gas Emissions and Sinks: 1990-2021 in absence of industry data.
4. Polyisocyanurate allocations are based on the following:

    a) For module A3 Manufacturing, blowing agent emissions in manufacturing are captured and processed via a thermal oxidizer. As a result, emissions to the environment are negligible. Source data: https://www.ipcc.ch/site/assets/uploads/2018/03/sroc_full-1.pdf (*see* Table 7.7).
    b) For module A5 (Installation), assume negligible blowing agent emissions (~1%) to the environment associated with typical installation practices.
    c) For modules B1 (Use Phase), the initial rate of blowing agent emissions in year 1 is 0.5% with decreasing rate over the product's lifespan. Source data: https://www.ipcc.ch/site/assets/uploads/2018/03/sroc_full-1.pdf (*see* Table 7.7).
    d) For module C4 (Disposal of waste), blowing agent emissions to the environment are estimated based on typical removal/decommissioning and disposal practices.
    e) GWP values for pentane are based on WMO (World Meteorological Organization), Scientific Assessment of Ozone Depletion: 2022, GAW Report No. 278, 509 pp.; WMO: Geneva, 2022. Annex Table A-5: Atmospheric abundances; lifetimes; radiative efficiencies; direct effect global warming potentials for 20-, 100-, and 500-year time horizons; and global temperature change potentials for 50- and 100-year time horizons. Available at: https://ozone.unep.org/system/files/documents/Scientific-Assessment-of-Ozone-Depletion-2022.pdf
5. Spray Foam allocations are based on the following:
    a) For module A3 (Manufacturing), blowing agent emissions are measured by manufacturers to be between 0.1 to 2%.
    b) For module A5 (Installation), 15% blowing agent emissions from high-pressure spray foam during installation. Source data: Ashford, P. and A. Vetter, 2004: Assessing the Role of HFC Blown Foam in European Building Renovation Strategies. Caleb Management Services, Bristol, UK. Proceedings of the 15th Annual Earth Technologies Forum, April 13-15, 2004, Washington, D.C., USA.
    c) For modules B1 (Use Phase), the rate of blowing agent emissions is based on reduction of thermal resistance measured for foam installed on roofing products after 40-50 years using CFC and HCFC blowing agents. Blowing agent release from foam plastic is a diffusion process significantly impacted by exposed surface area to volume ratios, substrates and coatings.
    d) For module C4 (Disposal of waste), blowing agent emissions to the environment are estimated based on typical removal/decommissioning and disposal practices. No data exists for spray foam blowing agent release when disposed into a landfill over the 100 year period. It is conservatively assumed that no blowing agent remains in the material placed in a landfill and is allocated to the C4 Disposal of Waste module.

3.12. Comparability and benchmarking

Comparison of EPD results between products may be included in this section per the requirements in UL Part A, Section 10.

4. LCA: Scenarios and Additional Technical Information

The following scenario technical information is a basis for the declared modules or may be used for developing specific scenarios in the context of a building assessment. EPDs shall use the following default scenario assumptions based on the relevant insulation subcategory unless 1) primary data are available, 2) more up-to-date published industry-average data are available, or 3) justified otherwise.

The following information shall be reported for declared modules. Irrelevant or non-applicable module rows may be excluded in the EPD; additional information may also be listed if necessary.

Table 8. Transport to building site assumptions (A4) for blanket, loose-fill and manufactured boards (see Table 9 for open-, closed-cell, and roofing applications)

Name	Compressed packaging (blanket, loose-fill)	Manufactured boards	Unit
Fuel type	Diesel		
Vehicle type	53’ Tractor-trailer		
Transport distance	800	320	km
Capacity utilization (including empty runs, mass based	65		%
Gross density of products transported	Determined from the density of liquid components or the compressed insulation packages	Calculated from functional unit weight and thickness	kg/m³
Capacity utilization volume factor (factor: '=1 or <1 or ≥ 1 for compressed or nested packaging products)	≥1	1	

Table 9. Transport to the building site (A4) assumptions for open cell, closed cell, and installed on-site roofing applications (see Table 8 for blanket, loose-fill and manufactured board assumptions)

Name			Open Cell	Closed Cell		Roofing		Unit
				HFO	HFC	HFO	HFC	
Fuel type			Diesel					
Vehicle type	Semi-truck, 12t – 30t		154	226	62	678	39	km
	Semi-truck, >30t		613	669	752	118	844	km
	Refrigerated truck		170	120	117	191	0	km
Capacity utilization			100					%
Gross density of products transported			10	31	31	52	52	kg/m3
Capacity utilization volume factor (factor: '=1 or <1 or ≥ 1 for compressed or nested packaging products)		N/A						

Table 10. Installation into the building (A5) (values are per functional unit)

Name	Open cell	HFO Closed	HFC Closed	HFC Roof	HFO Roof	Installed On-site (e.g. sprayed and loose-fill)	Manufactured (e.g. board and blanket)	Unit
Ancillary materials (Lubricants unless noted otherwise)	3.00E-06	6.80E-06	6.50E-06	1.02E-05	1.00E-05	-	0.0012 Fasteners 0.0012 Adhesive	kg
Electricity consumption	0.018	0.041	0.039	0.061	0.060	0.044	0.012	kWh
Diesel fuel for onboard generators	1.268	2.875	2.748	4.312	4.227	0.37	0.37	MJ
Product loss	0.011	0.025	0.024	0.038	0.038	0.02	0.02	%
Direct emissions to ambient air, soil and water (See Section 0 for Blowing Agent Allocation)	0	0.0028	0.0032	0.0038	0.0030	-	-	kg
VOC emissions**	Use primary data							µg/m^3

* Method used to calculate and report airborne dust shall be identified and/or described

**The VOC emissions shall be determined in accordance with the "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers- version 1.2[5]". California Department of Public Health Specification 01350.

[5] Available at: https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/CDPH%20Document%20Library/CDPH-IAQ_StandardMethod_V1_2_2017_ADA.pdf

Replacement (B4) (Roofing applications only)

The number of replacements of thermal insulation for roofing applications expected during building ESL of 75 years shall be declared. For roofing applications, the RSL value of 40 years shall be used, this means the replacement cycle shall be reported as 0.9. This fraction represents the quantity of product produced in stages A1-A3 necessary to meet replacement needs throughout the building's estimated service life (ESL) and is recorded under module B4.

For other thermal insulation applications that require replacement during building ESL, the expected RSL value and the corresponding number of replacements shall be declared. Assumptions and key parameters shall be clearly stated and supporting documentation to justify the assumptions made shall be provided.

Replacements should be rounded-up to the nearest tenths of the ESL of the building; e.g., 0.875 rounded to 0.9.

Table 11. Replacement (B4) (Roofing insulation)

Name	Value	Unit
Reference Service Life	40	Years
Replacement cycle	0.9	(ESL/RSL) - 1
Energy input, specified by activity, type and amount		kWh
Direct emissions to ambient air, soil and water		kg
Further assumptions for scenario development, e.g. frequency and time period of use		As appropriate

Table 12. End of life (C1-C4)

Name		Value	Unit
Demolition (module C1)		State assumption	kWh
Transport (module C2)		State assumption	km
Collection process	Collected with mixed construction waste	Functional unit mass*	kg
Recovery (module C3)	Landfill	Functional unit mass*	kg
Disposal (module C4)	Product or material for final deposition	Functional unit mass*	kg
Blowing agent emissions		See Section 3.11 for allocation	kg
Removals of biogenic carbon (excluding packaging)		Primary data	kg CO_2

*** The functional unit mass should be adjusted to account for any mass loss due to off-gassing**

Table 13. Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)		MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)		MJ
Net energy benefit from material flow declared in C3 for energy recovery		MJ
Process and conversion efficiencies		
Further assumptions for scenario development (e.g. further processing technologies, assumptions on correction factors);		

5. LCA: Results

5.1. LCIA and LCI results

In Table 14, "Description of the system boundary," all declared modules shall be indicated with an "X". All LCA results shall be reported per the requirements in the UL Part A unless otherwise specified in this Part B. Modules A1, A2, and A3 shall not be aggregated and shall be declared separately.

Per Part A, life cycle impact assessment (LCIA) results shall be reported for each declared module as follows. Results shall be declared with three digits using scientific notation (e.g. 1.23E-5 = 0.0000123) for each module. A uniform format shall be used for all indicator values.

- North America (Part A, Section 4.7, Table 7, TRACI indicators), with the following additions:
  - GWP impacts shall be calculated and reported as four separate indicators: GWP total, GWP fossil, GWP biogenic, and GWP luluc using the IPCC AR5 methodology.

- Results derived from the product life cycle inventory (LCI) shall be reported as follows:
  - Resource use indicators (Part A, Section 4.1, Table 4)
  - Output flows and waste category indicators (Part A, Section 4.1.2, Table 5)
  - Carbon emissions and removals (Part A, Section 4.6, Table 6)

Table 14. Description of the system boundary modules

PRODUCT STAGE			CONSTRUCT - ION PROCESS STAGE		USE STAGE					END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY	
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**D**	
Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential	Reference Service Life
					B6 Operational Energy Use of Building Integrated System During Product Use **B7** Operational Water Use of Building Integrated System During Product Use										

5.2. Reporting Product-Specific Results per Functional Unit

An insulation product family may include multiple similar products that vary by (i) mass per functional unit and/or (ii) facer option.

Per ISO 21930:2017 section 5.3, product-average EPDs shall be permitted – where the EPD reports a single set of results representing an average of similar products. The EPD owner may provide product-specific results for each product in a product family. If a product varies in its results by more than 10% from the average, it is required per ISO 21930:2017 to be reported separately.

An EPD owner may provide product-specific results for several products in a product family by using either of two options. The first option is to report separate results (as separate EPDs, or as separate results within one EPD) for each specific product. This option is recommended when there are relatively few specific products. There is no further guidance related to this option.

The second option is to provide an equation and required data (as specified in the guidance below) for the EPD user or software tool to calculate product-specific LCA results. This second option is recommended when there are relatively many specific products. Where the EPD uses this second option, the EPD shall use the following guidance to promote consistency in how results are reported in EPDs covered by this PCR.

Note: All of the guidance in this Section is for reporting and/or calculating results per functional unit of insulation product (1 m2 with a thermal resistance of RSI = 1 m2K/W). See Section 7.4 for the reporting and/or calculating of results for various product thicknesses or R-values (different from the functional unit) for the purpose of project-specific analysis.

The guidance includes scenarios for a product family where one or both of the following conditions apply:

- Specific products with different mass per functional unit
  Some insulation product families include a range of specific products that share a similar production process and similar formulation and differ by density and/or thermal resistivity (R-value per inch). These differences correspond to different mass per functional unit, which corresponds to different LCA results per functional unit. (This guidance shall not be used for insulating materials with significantly different production processes or formulations.)

- Specific products with different facer options

The EPD shall provide one of the following equations from Section 5.2.1 and accompanying required data and instructions to calculate product-specific results. The appropriate equation and required data depend on which conditions above apply.

5.2.1. EPD with Different Mass per Functional Unit and Different Facer Options

For specific products with different mass per functional unit and with different facer options, the EPD shall provide the following:

5.2.1.1. Equation

Result_PS = (Result_Ref x multiplier_PS) + (Result_facer x number-of-facers)

Where:

- ***Result_PS*** = product-specific result per functional unit
- ***Result_ref*** = result for the (unfaced) reference product [from Table [#][6]]
- ***multiplier_PS*** = product-specific functional unit multiplier [from Table [#]]
- ***Result_facer*** = result for 1 m2 of facer material [from Table [#]]
- ***Number-of-facers*** = number of facers on the product (1 or 2)

5.2.1.2. Required Data

- ***Result_ref***
  - **The EPD shall provide** the main results tables for a reference product in the product family.
  - These shall include all required LCA results per Section 5 and the PCR Part A.
  - These reference results shall be for unfaced insulating material only.
- ***multiplier_PS***
  - **The EPD shall provide** the multipliers following the example in Table A below.
  - EPD developer calculates the multipliers and reports the underlying calculations following the guidance in “Product-specific functional unit multipliers” below.
- ***Result_facer***
  - **The EPD shall provide** LCA results per 1 m2 for each facer type. These shall include all required LCA results per Section 5 and the PCR Part A.

[6] In cases where this PCR states: "Table [#]," the EPD owner shall insert the appropriate table number in their EPD where the user can find the relevant information.

○

5.2.1.3. Instructions and Calculation Example

The EPD shall include the following instructions:
"This calculation method can be used to derive a result for any or all declared indicators and for any reported life module(s). When using this equation, the EPD user defines which indicator and life cycle stage(s) they are using to calculate a product-specific result. The *Result_PS*, *Result_ref*, and *Result_facer* values must all align with the same indicator and life cycle stage(s) included."
The EPD shall include a calculation example following the template format below. The EPD's example shall be based on actual data from the EPD, not the data used in this template.
Desired result: cradle-to-grave (A1-C4) GWP for 1 functional unit of Type XV insulation with Facer A on one side.
Data inputs:

- *Result_ref* = 2.64 kg CO2e. [from Table [#]]
- *multiplier_PS* = 2.79 [from Table [#]]]
- *Result_facer* = 0.15 kg CO2e Table [#]]
- *number-of-facers* = 1

The product-specific result can be calculated as:
Result_PS = (Result_Ref x multiplier_PS) + (Result_facer x number-of-facers)
Result_PS = (2.64 kg CO2e x 2.79) + (0.15 kg CO2e x 1)
Result_PS = 7.37 kg CO2e + 0.15 kg CO2e
Result_PS = 7.52 kg CO2e

5.2.2. EPD with No Facer Option

For specific products with different mass per functional unit of and no facer options, the EPD shall provide the above from Section 5.2.1, with the following differences.

The EPD shall provide the simplified equation:

Result_PS = Result_Ref x multiplier_PS

The EPD shall include the definitions and required data outlined in 5.1.1 for: ***Result_PS, Result_ref***, and ***multiplier_PS***.

5.2.3. EPD for Product with the Same Unfaced Mass per Functional Unit

For specific products with the same mass per functional unit (unfaced) and with different facer options, the EPD shall provide the above from Section 5.2.1, with the following differences.

The EPD shall provide the simplified equation:
Result_PS = Result_Ref + (Result_facer x number-of-facers)

The EPD shall include the definitions and required data outlined in Section 5.2.1 for: ***Result_PS, Result_ref,*** and ***Result_facer***.

5.2.4. Calculating and Reporting Product-specific Functional Unit Multipliers

The EPD developer shall calculate a given product's product-specific functional unit multiplier in accordance with the following equation:

[Specific product's mass per functional unit (unfaced)] / [Reference product's mass per functional unit (unfaced)]

[Attached worksheet A] shall be used to calculate product-specific multipliers. [Attached worksheet A] allows the EPD developer to input either (i) reference product and specific product density and R-value per inch OR (ii) reference product and specific product mass. The LCA report shall include this worksheet or similar documentation of the product-specific multiplier determination.

The EPD shall include a table that includes the product-specific functional unit multipliers. See example Table 15 below.

Table 15. Example table of product-specific functional unit multipliers.

Product	Product-specific functional unit multiplier (*multiplier_PS*)
Product A	0.90
Product B	1.00
Product C	1.21
Product D	2.79

6. LCA: Interpretation

Interpretation requirements for the Project Report are provided in UL Part A, Section 5.

In addition, an interpretation shall be provided in the LCA and EPD which discusses:

- Identification of significant issues based on the results of the LCI and LCIA phases of the LCA;
- An evaluation that considers completeness, sensitivity, and consistency checks; and
- Conclusions, limitations and recommendations

This interpretation shall also include a description of the time frame and/or variance of the LCIA results if the EPD is valid for several products. An illustration of the results with figures is recommended in the EPD, e.g. for the dominance analysis, the distribution of impacts across the modules, the CO2-balance, etc. as appropriate for a reader's understanding of the environmental profile of the declared product. See ISO 14044 Section 4.5 for additional guidance.

7. Additional Environmental Information

7.1. Environment and health during manufacturing

Measures relating to environmental and health protection during the product manufacturing process extending beyond national guidelines (of the production country) may be described, e.g. reference to a product safety data sheet (SDS), description of Environmental Management Systems or similar, programs addressing air emissions, wastewater, noise, etc.

7.2. Energy savings during use

During its service life, insulation significantly reduces the energy use in a building, thereby reducing the impact on the environment. Use-stage environmental benefits of insulation during building operations can be significant as low thermal conductivity attributes of insulation limit utility consumption and associated environmental impacts. The exclusion of the building heating and cooling during the insulation material’s use phase severely underestimates the benefits that insulation has on the environment. This section may describe the energy savings and environmental benefits during use of the product in a building and only references operational consideration.

Average Expected Savings Approach:

As the calculation of the use-phase emission reduction for a specific project may be a time-intensive endeavor that is not practical for all projects and applications, an average expected reduction value can be included. These values are the result of a robust Energy Plus-based calculation of the expected emission reductions over the useful life of the installed building thermal envelope insulation.

For more information on the details of the building models used, baseline (without insulation) and installed

insulation levels (minimum code required), emission rates assumptions, and range of estimated emission reduction values by climate zone please review the 3rd party report: Impact of Building Envelope Thermal Insulation on Use-Phase Emissions, ICF, 2024.

Table 16. Average Operational Avoided Emissions for Residential Applications

ASHRAE 169-2020 Climate Zone																Unit
1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	All	
82	123	179	211	193	177	273	241	246	343	313	269	430	391	480	574	283	kg CO2e per FU

Table 17. Average Operational Avoided Emissions for Commercial Applications

ASHRAE 169-2020 Climate Zone																Unit
1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	All	
325	353	456	578	523	311	696	614	555	818	786	589	1002	929	1015	1218	673	kg CO2e per FU

Calculation of Benefits Approach:

Scenarios involving comparisons of operating energy savings to embodied energy as measured by Primary Energy Demand (PED) may be provided. Primary Energy refers to the renewable and non-renewable forms of energy extracted from nature, for example, crude oil or solar energy, and embodied in raw materials or as an energy carrier.

Executing an analysis that demonstrates the use-phase environmental benefits of the declared insulation product involves establishing a building operation scenario compared to a baseline scenario. Such an analysis includes a reasonably accurate estimate of both scenarios in order to establish a quantified energy savings delta to compare with the environmental impact deltas.

There are a few energy estimating methods employed by the various energy simulation programs. Due to its ease of use the Degree-Day Method is frequently utilized. However, this method is based on steady-state calculations. As stated in the ASHRAE 2021 Handbook of Fundamentals Chapter 19 (page 19.6) it "is limited in that it does not consider the effects of solar heat gain or building thermal mass, nor can it account for variations in infiltration and ventilation rates or thermostat settings (such as night setback)." These are quite normal conditions in commercial buildings and therefore, the use of the Degree-Day Method does not provide reliability for this analysis. Whole building simulation tools based on rigorous calculations, such as the Heat Balance Method would be suitable for this analysis.

7.3. Environment and health during installation

Information should be provided in this section on the relationship between the product, the environment and health, including any possible harmful substances or emissions e.g. reference to a product safety data sheet (SDS). Any recommendations concerning cleaning, maintenance, etc. of the declared product should be listed in Section 4 “Technical information on scenarios”.

7.4. Market Scaling Factors and Estimating Impacts of Products at Different R-value than the Functional Unit

Where insulation products have a linear R-value and no facers, the impacts can easily be scaled. For example, such a product at RSI-2 would have twice the impact as the same product at RSI-1. In this case, one could calculate the impact for any thickness of product purchased or installed, using the R-value and the EPD’s reported impact per functional unit. Where the represented product has a linear R-value and no facers, the EPD shall declare the following:

> *“The impacts for this product scale linearly and are directly proportional to R or RSI-value. The LCA result per 1 m^2 at the thickness and R-value specified equals the LCA result of the functional unit times the specified RSI value.”*

Where insulation products have R-values that are not linear or include facers, the impacts are not scalable in the same linear fashion. For example, a faced product at RSI-2 would NOT have twice the impact as the same faced product at RSI-1. In such cases, the EPD shall provide the information necessary to calculate the impacts of products as designed, purchased, or installed for a given project.

Where the represented product has non-linear R-value and/or has facers, the EPD shall include the following language:

> *The environmental impact results in this EPD have been calculated for the functional unit of insulation, which has a surface area of 1 m^2 and a thermal resistance of RSI = 1 m^2K/W. In Imperial units, this thermal resistance, or R-value, is equivalent to 5.678 hr·ft^2·°F/BTU. To calculate total impact values for insulation at a specified project-determined thickness and R-value, with or without a specific facing material, the following equation may be used:*
>
> Product-specific result per 1 m^2 at the thickness and R-value specified
> = ***Result_PS = (Result_Ref x MarketScalingFactor) + (Result_facer x number-of-facers)***
>
> For product families with no facers, the EPD may use the simplified equation:
> Product-specific result per 1 m^2 at the thickness and R-value specified
> = ***Result_PS = Result_Ref x MarketScalingFactor***

The EPD shall additionally provide a table of market scaling factors. See Table 18 for an example.

Table 18. Example market scaling factors. Note: The values do *NOT* correspond to a functional unit as the products/thicknesses listed have different R-values.

Product Type	Market Scaling Factors for Product-as-Marketed Results		
	0.5"	1.0"	2.0"
Product A	0.257	0.513	1.026
Product B	0.317	0.633	1.267
Product C	0.464	0.927	1.855
Product D	2.465	4.931	9.861

The EPD shall include a calculation example following the template format below. The EPD's example shall be based on actual data from the EPD, not the data used in this template.

In cases where this PCR states: "Table [#]," the EPD owner shall insert the appropriate table number in their EPD where the user can find the relevant information.

Desired result: Cradle-to-grave (A1-C4) GWP for 1 m^2 of Product D insulation with Facer A on one side.
Data inputs:

- *Result_ref* = 2.64 kg CO2e. [from Table [#][7]]
- *MarketScalingFactor* = 2.465 [from Table [#]]
- *Result_facer* = 0.15 kg CO2e [from Table [#]]
- *number-of-facers* = 1

The product-specific impact per product thickness and R-value specified can be calculated as:
= ***Result_PS = (Result_Ref x MarketScalingFactor) + (Result_facer x number-of-facers)***
= (2.64 kg CO2e x 2.465) + (0.15 kg CO2e x 1)
= 6.51 kg CO2e + 0.15 kg CO2e
= 7.66 kg CO2e

[7] In cases where this PCR states: "Table [#]," the EPD owner shall insert the appropriate table number in their EPD where the user can find the relevant information.

Calculating the market scaling factors
The EPD developer shall calculate a given product's market scaling factors in accordance with the following equation:

[*specific product's mass per 1 m^2 at the specified thickness and R-value (unfaced)*] /
[*reference product's mass per functional unit (unfaced)*]

Exception: Where the represented product has facers and a linear R-value, the EPD may provide a table of results (including facers) at standard product thicknesses, in place of an equation and market scaling factors.

7.5. Delayed Emissions

If a manufacturer wishes to declare quantitative or qualitative information on delayed emissions used to calculate Global Warming Potential, information shall be provided here. See Part A, Section 4.4 for more information. If information on delayed emissions is included in this section, the manufacturer shall provide the methodology used in the EPD and submit supporting calculations and methodologies in the LCA background report.

7.6. Environmental Activities and Certifications

Other environmental activities, such as participation in recycling or recovery programs along with the details of these programs and contact information, shall be provided.

For certifications applied to the product and listed in the EPD, a statement shall be included on where an interested party can find details of the certification program.

7.7. Further Information

A reference source for additional information may be provided here, e.g. homepage, reference source for safety data sheet.

8. Supporting Documentation

Requirements for the LCA background report, also known as the Project Report, to support an EPD created using this document are provided in Part A: Section 2. Project Report elements include general information (Part A: Section 2.1), study goal (Part A: Section 2.2), study scope (Part A: Section 2.8), and the life cycle inventory analysis, impact assessment, and interpretation (Part A: Section 3, 4, and 5). Additionally, the Project Report shall include additional required supporting documentation specified in this sub-category Part B and according to Part A: Section 6.

If relevant to the scope of the declared product, or due to the product material composition, it is recommended to provide sufficient supporting documentation in the EPD and Project Report. When providing documentation, testing protocols and other relevant information shall be indicated. If supporting documentation is not provided, the reasons shall be indicated in the EPD and Project Report.

As a general rule, all statements shall be documented with measured data (presented by the corresponding test certificates). In the case of non-verifiable substances, the limit of detection shall be included in the declaration. Interpreting statements such as "… free of …" or "… are entirely harmless …" are not permissible.

9. References

The literature referred to in the Environmental Product Declaration shall be quoted in full from the following sources. Standards and standards relating to evidence and/or technical features already fully quoted in the EPD do not need to be listed.

ISO Standards:

ISO 14025:2006
International Organization for Standardization. (2006). *ISO 14025:2006 - Environmental labels and declarations — Type III environmental declarations — Principles and procedures.*

ISO 14040:2006
International Organization for Standardization. (2006). *ISO 14040:2006 - Environmental management – Life cycle assessment – Principles and framework.*

ISO 14044:2006
International Organization for Standardization. (2006). *ISO 14044:2006 - Environmental management – Life cycle assessment – Requirements and guidelines.*

ISO 14046:2014
International Organization for Standardization. (2014). *ISO 14046:2014 - Environmental management- Water footprint- Principles, requirements and guidelines.*

ISO 15392:2008
International Organization for Standardization. (2008). *ISO 15392:2008 - Sustainability in building construction- General principles.*

ISO 15686-1:2011
International Organization for Standardization. (2011). *ISO 15686-1:2011 - Buildings and constructed assets- Service life planning- Part 1: General principles.*

ISO 15686-2:2012
International Organization for Standardization. (2012). *ISO 15686-2:2012 - Buildings and constructed assets- Service life planning Part 2: Service life prediction procedures.*

ISO 15686-7:2017
International Organization for Standardization. (2017). *ISO 15686-7:2017 - Buildings and constructed assets- Service life planning Part 7: Performance evaluation for feedback of service life data from practice.*

ISO 15686-8:2008
International Organization for Standardization. (2008). *ISO 15686-8:2008 - Buildings and constructed assets- Service life planning Part 8: Reference service life and service life estimation.*

ISO 21930:2017
International Organization for Standardization. (2017). *ISO 21930:2017 - Sustainability in building construction — Environmental declaration of building products.*

EN Standard:

EN 15804:2012+A2:2019/AC:2021
European Committee for Standardization. (2019). *EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.*

Testing and Classification References:

American Conference of Governmental Industrial Hygienists (ACGIH®)
Threshold Limit Values and Biological Exposure Indices.
Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
(2017). *Version 1.2, January 2017.*

ASHRAE:

ASHRAE Standard 90.1:
ANSI/ASHRAE. (2022). Standard 90.1-2022: Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

ASHRAE Standard 90.2:
ANSI/ASHRAE. (2022). Standard 90.2-2022: Energy-Efficient Design of Low-Rise Residential Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

ASHRAE Standard 189.1:
ANSI/ASHRAE. (2023). Standard 189.1-2023: Standard for the Design of High-Performance Green Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

ASTM Standards:

ASTM C208-22:
ASTM International. (2022). ASTM C208-22: Standard Specification for Cellulosic Fiber Insulating Board.

ASTM C549-23:
ASTM International. (2023). ASTM C549-23: Standard Specification for Perlite Loose Fill Insulation.

ASTM C552-22:
ASTM International. (2022). ASTM C552-22: Standard Specification for Cellular Glass Thermal Insulation.

ASTM C578-23:
ASTM International. (2023). ASTM C578-23: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

ASTM C665-23:
ASTM International. (2023). ASTM C665-23: Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

ASTM C726-17:
ASTM International. (2017). ASTM C726-17: Standard Specification for Mineral Fiber Roof Insulation Board.

ASTM C728-22:
ASTM International. (2022). ASTM C728-22: Standard Specification for Perlite Thermal Insulation Board.

ASTM C739-24:
ASTM International. (2024). ASTM C739-24: Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.

ASTM C764-19:
ASTM International. (2019). ASTM C764-19: Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation.

ASTM C991-23:
ASTM International. (2023). ASTM C991-23: Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.

ASTM C1014-17:
ASTM International. (2017). ASTM C1014-17: Standard Specification for Spray-Applied Mineral Fiber Thermal and Sound Absorbing Insulation.

ASTM C1029-20:
ASTM International. (2020). ASTM C1029-20: Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.

ASTM C1086-20:
ASTM International. (2020). ASTM C1086-20: Standard Specification for Glass Fiber Mechanically Bonded Felt Thermal Insulation.

ASTM C1126-19:
ASTM International. (2019). ASTM C1126-19: Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

ASTM C1149-23:
ASTM International. (2023). ASTM C1149-23: Standard Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation.

ASTM C1289-23a:
ASTM International. (2023). ASTM C1289-23a: Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

ASTM C1303/1303M-23:
ASTM International. (2023). ASTM C1303/1303M-23: Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation.

ASTM C1482–24e1:
ASTM International. (2024). ASTM C1482–24e1: Standard Specification for Polyimide Flexible Cellular Thermal and Sound Absorbing Insulation.

ASTM C1484-18:
ASTM International. (2018). ASTM C1484-18: Standard Specification for Vacuum Insulation Panels.

ASTM C1497-24:
ASTM International. (2024). ASTM C1497-24: Standard Specification for Cellulosic Fiber Stabilized Thermal Insulation.

ASTM C1594-23:
ASTM International. (2023). ASTM C1594-23: Standard Specification for Polyimide Rigid Cellular Thermal Insulation.

ASTM D6670-01(2018):
ASTM International. (2018). ASTM D6670-01(2018): Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.

ASTM D7143-17:
ASTM International. (2017). ASTM D7143-17: Standard Practice for Emission Cells for the Determination of Volatile Organic Emissions from Indoor Materials/Products.

ASTM E1333-22:
ASTM International. (2022). ASTM E1333-22: Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.

CAN/ULC Standards:

CAN/ULC-S701.1:2022:
Underwriters Laboratories of Canada. (2022). CAN/ULC-S701.1:2022: Standard for Thermal Insulation, Polystyrene Boards.

CAN/ULC-S702.1:2021:
Underwriters Laboratories of Canada. (2021). CAN/ULC-S702.1:2021: Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

CAN/ULC-S703-09(R2020):
Underwriters Laboratories of Canada. (2020). CAN/ULC-S703-09(R2020): Standard for Cellulose Fibre Insulation for Buildings.

CAN/ULC-S704.1:2023:
Underwriters Laboratories of Canada. (2023). CAN/ULC-S704.1:2023: Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

CAN/ULC-S705.1:2018:
Underwriters Laboratories of Canada. (2018). CAN/ULC-S705.1:2018: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.

CAN/ULC-S706.1:2020:
Underwriters Laboratories of Canada. (2020). CAN/ULC-S706.1:2020: Standard for Insulating Wood Fibre Boards for Buildings.

CAN/ULC-S712.1:2021:
Underwriters Laboratories of Canada. (2021). CAN/ULC-S712.1:2021: Standard for Thermal Insulation – Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam – Material Specification.

CAN/ULC-S770-15(R2020):
Underwriters Laboratories of Canada. (2020). CAN/ULC-S770-15(R2020): Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

Federal Standards and SOPs:

Environment Canada, National Pollutant Release Inventory (NPRI)
Environment Canada. (2024). *National Pollutant Release Inventory (NPRI).*

EPCRA 313 Toxic Release Inventory Reporting (U.S.)
United States Environmental Protection Agency. (2024). *EPCRA 313 Toxic Release Inventory Reporting.*

US EPA, ORD/NRMRL/Sustainable Technology Division, Systems Analysis Branch
United States Environmental Protection Agency. (2012). *SOP No. S-10637-OP-1-0: Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI), TRACI version 2.1, USER'S MANUAL.* Office of Research and Development, National Risk Management Research Laboratory, Sustainable Technology Division.

US EPA. Advancing Sustainable Materials Management: 2014 Tables and Figures
United States Environmental Protection Agency. (2016). *Advancing Sustainable Materials Management: 2014 Tables and Figures Assessing Trends in Material Generation, Recycling, Composting, Combustion with Energy Recovery and Landfilling in the US.*

US: Resource Conservation and Recovery Act (RCRA), Clause C
United States Environmental Protection Agency. (2024). *Resource Conservation and Recovery Act (RCRA), Clause C.*

40 CFR 50 Protection of Environment - Part 50: National Primary and Secondary Ambient Air Quality Standards (U.S.) US EPA. (2024). *40 CFR 50: Protection of Environment - National Primary and Secondary Ambient Air Quality Standards.*

Clean Air Act (CAA) Section 112(r): Accidental Release Prevention/Public Management Rule
United States Environmental Protection Agency. (2024). *Clean Air Act (CAA) Section 112(r): Accidental Release Prevention/Public Management Rule.*

CERCLA Hazardous Substances (U.S.) United States Environmental Protection Agency. (2024). *CERCLA Hazardous Substances.*

ODSHAR. Government of Canada, Ozone-depleting Substances and Halocarbon Alternatives Regulations, SOR/2016-137 Government of Canada. (2016). *Ozone-depleting Substances and Halocarbon Alternatives Regulations, SOR/2016-137.*

Phasedown of Hydrofluorocarbons: Restrictions on the Use of Certain Hydrofluorocarbons Under the American Innovation and Manufacturing Act of 2020. United States Environmental Protection Agency. (2023). *Phasedown of Hydrofluorocarbons: Restrictions on the Use of Certain Hydrofluorocarbons Under the American Innovation and Manufacturing Act of 2020.* (Effective January 1, 2025)

U.S. Department of Labor, Occupational Safety & Health Administration (OSHA 1910.1200)
United States Department of Labor, Occupational Safety & Health Administration. (2024). *Hazard Communication Standard—Toxic and Hazardous Substances.*

PCRs and PCR Guidance:

American Center for Life Cycle Assessment (ACLCA)
American Center for Life Cycle Assessment. (2024). *Product Category Rule Development, v1.0, established by the Product Category Rule Guidance Development Initiative.*

UL Part A UL Solutions
UL Solutions. (2018). *PCR for Insulated Metal Panels, Metal Composite Panels, and Metal Cladding: Roof and Wall Panels.*

PCR prepared by Næringslivets Stiftelse for Miljødeklarasjoner (Norwegian EPD Foundation)
Næringslivets Stiftelse for Miljødeklarasjoner (Norwegian EPD Foundation). (2012). *PCR for Insulation Materials.*

PCR Guidance-Texts for Building-Related Products and Services, IBU
Institute of Construction and Environment e.V. (IBU). (2014). *Part B: Requirements for the EPD for Calcium Silicate Insulating Materials, v1.6.*
Institute of Construction and Environment e.V. (IBU). (2014). *Part B: Requirements for the EPD for Insulating Materials Made of Foam Plastics, v1.6.*
Institute of Construction and Environment e.V. (IBU). (2014). *Part B: Requirements for the EPD for Mineral Insulating Materials, v1.6.*
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