



Product Category Rule for Environmental Product Declarations

PCR for Gypsum Panel Products



Program Operator

NSF International

National Center for Sustainability Standards

Valid through July 17, 2024

ncss@nsf.org

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PRODUCT CATEGORY RULES REVIEW PANEL

Program Operator

NSF International

Recommended for adoption by

The PCR Committee for Concrete

No participation fees were charged by NSF to interested parties. NSF International ensured that reasonable balance among the members of the PCR committee were achieved and potential conflicts of interest were resolved prior to commencing this PCR development.

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NSF International shall ensure that reasonable balance among the members of a PCR committee is achieved and potential conflicts of interest are identified. No participation fees will be charged by NSF International to interested parties for participation on PCR Development Committees, for attendance at PCR Development Committee meetings, or for commenting on a draft PCR document.



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TABLE OF CONTENTS

1 SCOPE.....5
 1.1 Interested parties.....5
 1.2 PCR development and stakeholder consultation5
 2 NORMATIVE REFERENCES6
 3 TERMS AND DEFINITIONS6
 4 ABBREVIATED TERMS8
 5 GENERAL ASPECTS 10
 5.1 Objectives of this PCR 10
 5.2 Life cycle stages..... 11
 5.3 Average EPDs for groups of similar products 12
 5.4 Use of EPDs for construction products 13
 5.5 Comparability of EPDs for construction projects..... 14
 5.6 Documentation 14
 6 PCR DEVELOPMENT AND USE 14
 7 PCR FOR LCA 14
 7.1 Methodological framework 14
 7.2 Inventory analysis..... 33
 7.3 Impact assessment indicators describing main environmental impacts derived from LCA 38
 8 ADDITIONAL ENVIRONMENTAL INFORMATION 39
 9 CONTENT OF AN EPD 40
 9.1 General..... 40
 9.2 Declaration of general information 40
 9.3 Declaration of methodological framework 41
 9.4 Declaration of technical information and scenarios..... 41
 9.5 Declaration of environmental indicators derived from LCA 45
 9.6 Declaration of additional environmental information 45
 10 PROJECT REPORT 46
 10.1 General..... 46
 10.2 LCA-Related elements of the project report..... 46
 10.3 Data confidentiality 46
 10.4 Documentation on additional environmental information 46
 10.5 Data availability for verification..... 46
 11 VERIFICATION AND VALIDITY 47
 12 REFERENCES..... 47



ABOUT NSF'S NATIONAL CENTER FOR SUSTAINABILITY STANDARDS (NCSS)

Through the National Center for Sustainability Standards, NSF develops life-cycle based, multi-attribute sustainability standards, protocols, and PCRs for various industries including building products and materials, furniture, carpet and flooring, fabrics, wallcoverings, roofing membranes, green chemicals, and water and wastewater.

The National Center for Sustainability Standards will continue to add to its growing portfolio while providing education, outreach, and innovative support to private industry, trade associations, government and academia to foster a consensus-based approach toward conformity assessment in the sustainability field. Visit www.nfsustainability.org or contact ncss@nsf.org.

To initiate your LCA, receive your EPD verification, or have questions on where to start, contact NSF Sustainability at sustainability@nsf.org or 734-476-2543.

ABOUT GYPSUM ASSOCIATION

The mission of the Gypsum Association (GA), a not-for-profit trade association founded in 1930, is to promote the use of gypsum while advancing the development, growth, and general welfare of the gypsum industry in the United States and Canada on behalf of its member companies.

Members include all the active gypsum board (panel) manufacturers in the United States and Canada. To be eligible for membership in the Association, a firm or corporation must calcine gypsum and manufacture gypsum board under the provisions of ASTM Standard C1396.



1 SCOPE

This set of Product Category Rules (PCR) was developed to specify the rules for the preparation of an Environmental Product Declaration (EPD) for Gypsum Panel Products for use in North America. The product group consists of interior and exterior gypsum panel products as defined by ASTM C11, *Standard Terminology Relating to Gypsum and Related Building Materials and Systems*.

This PCR is valid for five (5) years and expected to expire in July 17, 2024.

1.1 Interested parties

The Program Operator responsible for producing this PCR is NSF International.

Representatives of the following organizations participated in the development of the PCR:

- The Gypsum Association
- American Gypsum Company
- CertainTeed Gypsum
- Continental Building Products
- Georgia-Pacific Gypsum
- National Gypsum Company
- PABCO Gypsum
- United States Gypsum

1.2 PCR development and stakeholder consultation

This product category rule for 'gypsum' is Version 1.0 of combined requirements originally presented the following documents: FPI Innovations Gypsum Board Product Category Rules (PCR) issued September 2013, and ASTM Glass Mat Gypsum Panel PCR issued in January 2016. The resulting document has been developed in conformance with ISO 14025:2006 and ISO 21930:2017 (see references). This PCR included a public consultation period from March 8, 2019 through April 10, 2019.



2 NORMATIVE REFERENCES

The following documents are referred to in the text. For undated reference, the latest edition of the referenced document (including any amendments) applies:

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

Per ISO 21930:2017 Section 2, with the following additions:

ASTM C11 – 18b *Standard Terminology Relating to Gypsum and Related Building Materials and Systems*

ASTM E2921 – 16a *Standard practice for minimum criteria for comparing whole building life cycle assessments for use with building codes, standards, and rating systems*

3 TERMS AND DEFINITIONS

For the purposes of this document, the definitions given in ISO 6707-1:2017, ISO 14025:2006, ISO 14044:2006, ISO 14050:2009, ISO 15686-1:2011, ISO 21930:2017, and the following apply:

ancillary input: input material or product that is used by a unit process during the life cycle of the gypsum panel product, but which does not constitute part of the gypsum panel product.

average data: data representative of a product or service, provided by one or more suppliers, either from multiple plants or based on multiple similar construction products of the supplier.

declared unit: quantity of a construction product for use as a reference unit in an EPD based on LCA for the expression of environmental information in information modules (used when the reference scenario for the whole life cycle cannot be stated).



environmental product declaration (EPD): environmental declaration providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information.

estimated service life (ESL): service life that part of a construction works or building would be expected to have in a set of specific in-use conditions.

functional equivalent: quantified functional requirements and/or technical requirements for a building or an assembled system (part of the works) for use as a basis for comparison.

functional unit: quantified performance of a product system for use as a reference unit in an EPD based on LCA that includes all stages of the life cycle.

glass mat: a woven or non-woven fabric of glass fibers with or without a binder (ASTM C11 – 18b).

glass-mat gypsum board: the generic name for a family of sheet products consisting of a non-combustible core primarily of gypsum with a non-woven facing (ASTM C11 – 18b).

gypsum board: the generic name for a family of sheet products consisting of a non-combustible core primarily of gypsum with paper facing (ASTM C11 – 18b).

gypsum panel products: the general name for a family of sheet products consisting essentially of gypsum (ASTM C11 – 18b).

information module: compilation of data to be used as a basis for an EPD covering a unit process or a combination of unit processes that are part of the life cycle of a product.

life cycle assessment (LCA): compilation and evaluation of the inputs, outputs, and the potential environmental impacts of a product system throughout its life cycle.

life cycle inventory analysis (LCI): phase of LCA involving the compilation and quantification of inputs and outputs for a product throughout its life cycle.



life cycle impact assessment (LCIA): phase of LCA aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout its life cycle.

PCR review: process whereby a third party verifies the PCR.

product category: group of construction products that can fulfill equivalent functions.

product category rules (PCR): set of specific rules, requirements and guidelines for developing EPDs for one or more product categories.

program operator: body or bodies that conduct an EPD program.

reference service life (RSL): service life of a construction product which is known to be expected under a set of reference in-use conditions and which can form the basis for estimating the service life under other in-use conditions.

system boundary: boundary representing which unit processes are part of a product system.

third party: person or body that is recognized as being independent of the parties involved concerning the issues in question. [SOURCE: ISO 14024:1999, 3.7, modified]

4 ABBREVIATED TERMS

ADP_{elements}: abiotic depletion potential for non-fossil mineral resources

ADP_{fossil}: abiotic depletion for fossil resources

AP: acidification potential

B2B: business – to – business

B2C: business – to – consumer

CFC_{11e}: chlorofluorocarbon – 11 equivalent

C₂H_{2e}: acetylene equivalent

Ci: emission concentrations of individual compounds



EP: eutrophication potential

GWP: global warming potential

IM: information module

LCI_i : lowest concentration of interest value

NCV: net caloric value

NRPR_e: non-renewable primary resources used as an energy carrier (fuel)

NRPR_m: non-renewable primary resources with energy content used as materials

NRSF: non-renewable secondary fuels

ODP: ozone depletion potential

POCP: photochemical oxidant creation potential

PO_{4e}: phosphate equivalent

PS: product systems

R: risk

RE: recovered energy

R_i: individual risk-value ($=C_i/LCI_i$)

RPR_e: renewable primary resources used as an energy carrier (fuel)

RPR_m: renewable primary resources with energy content used as material

RSF: renewable secondary fuels

S_{be}: antimony equivalent

SB: system boundary

SF: secondary fuel

SO_{2e}: sulfur dioxide equivalent

WMO: World Meteorological Organization



5 GENERAL ASPECTS

5.1 Objectives of this PCR

Per ISO 21930 Section 5.1, with the following additions:

The primary objective of this PCR is to provide common rules specific to Gypsum Product Panel for the application ISO 21930:2017 for building and civil engineering works. It is intended for use by North American organizations for preparing EPDs for gypsum panel products for use in North American or export markets.

Additional objectives of the PCR are to:

- encourage gypsum producers to quantify, report, better understand and reduce environmental impacts of gypsum panel products;
- promote transparency and incentivize manufacture specific upstream data; and
- represent gypsum panel products appropriately following international standards for building materials and products.

This PCR covers gypsum panel products as defined in ASTM C11 – 18b family of sheet products consisting essentially of gypsum, including paper-faced gypsum board, glass-mat gypsum panels, fiber reinforced gypsum panels, and laminated gypsum panels.

The primary users of this PCR will be the Gypsum Association (GA) and its member companies, and North American gypsum board manufacturers.

This PCR specifies rules, requirements, and guidelines for developing EPDs for North American produced gypsum panel products and underlying requirements of related LCAs. This PCR is valid for, and provides requirements for, cradle-to-gate, cradle-to-gate with options, and cradle-to-grave EPDs. It does not address either the economic or social aspects of the product.



5.2 Life cycle stages

5.2.1 General

The system boundaries of the LCA and EPD shall follow the modular structure in line with ISO 21930: 2017, Section 5.2.1. This PCR encourages, when possible, LCAs and EPDs that are cradle-to-grave in scope (Modules A1-C4) but also recognizes LCAs and EPDs that are cradle-to-gate (Modules A1-A3) and cradle-to-gate with optional modules as being in scope.

5.2.2 Summary of EPD types and related system boundary requirements

Per ISO 21930 Section 5.2.2, with the following addition:

Table 1 summarizes the related modules, unit, and RSL required for each of the EPD type options available under this PCR.

Table 1
System boundary requirement per EPD type

EPD Type	Life Cycle Stages and Modules	Declared Unit or Functional Unit	Reference Service Life Specification
Cradle-to-gate	Product stage; Modules A1 to A3	Declared unit	Not specified
Cradle-to-gate with optional installation	Product and construction stage; Modules A1 to A5	Declared unit	Not specified
Cradle-to-gate with optional end-of-life	Product, and EOL stages; Modules A1 to A3 and C1 to C4	Declared unit	Not specified
Cradle-to-grave	Product, construction, use, and EOL stages; Modules A1 to A5, B1 to B7, and C1 to C4	Functional unit	75-year RSL required



5.2.3 Use of scenarios for assessment of information modules beyond the production stage

Per ISO 21930 Section 5.2.3.

5.3 Average EPDs for groups of similar products

Per ISO 21930 Section 5.3, with the following additions:

When preparing an average EPD for an identical product (gypsum panel) manufactured at multiple facilities, a mass-weighted average based on total annual production of each facility shall be used as the basis for calculating the average. Data reported in the declarations shall be as production mass-weighted averages of multiple facilities.

In cases where several similar gypsum panel products are produced by a facility or company, the PCR offers the possibility for similar products to be grouped as an “average gypsum panel” in the same EPD provided that the difference between their LCA results is equal to or less than 10% for each environmental parameter derived from LCA. In the case where the difference in the results exceed 10%, it is still possible to include average products in the same EPD, provided that the results for the individual products are included. In both cases the variation in composition should be reported as well as the type of average used to arrive at the final results. If a single value is chosen for each impact category for all products, the value reported should be the worst performance within the range of variation. It is also permissible to show arithmetically weighted averaged data in an EPD as supplementary information if found relevant.

Averaging of products may significantly reduce EPD development efforts by allowing manufacturers to use one LCA for multiple products. The range of products included in an EPD shall be justified in the context of EPD application; i.e., what the EPD represents. It is crucial that the reasoning be explained, and the average reported value can be understood. The method for creating a company specific individual product/product group EPD shall be described, including the method for determining a weighted average across products based on production volume.



5.4 Use of EPDs for construction products

Per ISO 21930:2017 Section 5.4, with the following additions:

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 one manufacturing location from each participating company should be involved and represented in an industry-average EPD. The method for determining the representativeness shall be documented and justified.

participation: In order to participate in an industry-average EPD, a manufacturer shall provide primary manufacturing data for the calculation of the initial EPD average.

retroactive participation: This PCR does not support the retroactive participation of companies in an industry-average EPD. Any company that did not participate in the initial industry-average EPD who want to participate must wait for the next update of the industry-average EPD.

benchmarking: Manufacturers that wish to publicly benchmark a product specific EPD against the industry-average EPD shall have participated in the industry-average EPD process.

ownership: An industry organization shall inform all eligible industry participants of the industry-average EPD process. Confidential business information shall be collected by a third party and be aggregated with no trace to the original source of the data. The development or update of an industry-average EPD should involve a series of meetings or exchanges to allow all participates the ability to contribute to the development.

updates: An update to an industry-average EPD, or new EPD, may need to be developed at the discretion of the EPD owner prior to the typical 5-year period due to the following:

- significant changes to the manufacturing process;
- significant changes to the raw material inputs; or
- major regulatory changes that affect operational procedures.



Additional companies wishing to participate in an industry-average EPD may be added to the industry-average at any time the industry-average EPD is updated or a new industry-average EPD developed.

5.5 Comparability of EPDs for construction projects

Per 21930 Section 5.5, with the following addition:

It shall be stated in EPDs created using this PCR that only EPDs prepared from cradle-to-grave life cycle results and based on the same function, RSL, quantified by the same functional unit, and meeting all the conditions for comparability listed in ISO 14025:2006 and ISO 21930:2017 can be used to comparison between products.

5.6 Documentation

Per ISO 21930:2017 Section 5.6.



6 PCR DEVELOPMENT AND USE

Per ISO 21930:2017 Section 6.



7 PCR FOR LCA

7.1 Methodological framework

7.1.1 LCA Modeling and calculation

Per ISO 21930 Section 7.1.1.



7.1.2 Functional unit

Per ISO 21930 Section 7.1.2, with the following additions:

A functional unit is defined for EPDs covering the complete cradle-to-grave life cycle or cradle-to-gate with a use stage scenario. If the EPD is intended to be used for comparison purposes, the entire life cycle must be included; therefore, a functional unit is used.

The functional unit for gypsum panel products is 92.9 m² (1000 ft²) of installed product with a RSL of 75 years. In the North American market, gypsum board is typically specified and sold on an area basis.

This PCR applies to a wide variety of gypsum panel product types, offered in a variety of thicknesses that may impact results. Since this PCR uses an area based functional unit, declarations for the thickness and mass shall be indicated in the appropriate table (see Table 2).

**Table 1
Functional (declared) unit properties**

Name	Value	Unit
Functional unit / declared unit	92.9 m ² (1000 ft ²)	
Mass		kg
Thickness		cm

7.1.3 Declared unit

Per ISO 21930 Section 7.1.3, with the following clarification:



A declared unit is defined for EPDs covering only the cradle-to-gate or cradle-to-gate plus end-of-life stages. A declared unit is not used for EPDs that include the use stage and cannot be used as a basis for comparison.

The declared unit for gypsum panel products is 92.9 m² (1000 ft²).

7.1.4 Requirements for use of reference service life (RSL)

Per ISO 21930 Section 7.1.4, with the following clarification:

This PCR assumes a RSL of 75 years, which is consistent with the 75-year building service life identified in ASTM E2921 (2013, Section 6.1.1) and ASHRAE 189.1 (2014, Section 9.5.1). The indication of the RSL is imperative for EPDs covering the complete use stage (modules B1-B7), or if a use stage scenario is described, which refers to the lifetime of the product. If not all modules of the use stage are declared, and no use stage scenario which refers to the lifetime of the product is described, the indication of the RSL is voluntary.

7.1.5 System boundary with nature

Per ISO 21930 Section 7.1.5.

7.1.6 System boundary between products systems

Per ISO 21930 Section 7.1.6, with the following clarifications:

The system boundary shall be specified in the LCA and EPD. The description should be specific as to what processes are considered in each module. Any relevant aspects not included in any module shall be supported with additional documented information and any omissions shall be justified.

Capital goods and infrastructure flows may be excluded from unit processes used to model the LCIA, unless they significantly affect the conclusions or results of the LCA. If included, the LCA should specify the lifetimes of any capital goods or infrastructure included and should specify the method used to allocate the impact burdens.



Human activity and personnel-related activity such as travel, furniture, office supplies, etc. may be excluded from unit processes used to model the LCIA. The data collection required to properly quantify human involvement is particularly complicated and allocation of such flows to the production of gypsum panel products as opposed to other societal activities is assumed not to be feasible.

Energy and water use related to the company management and sales activities that may be located either within the factory site or at another location may be excluded. If located within the manufacturing location, the method for allocating the energy and water use to be excluded as management or sales activities shall be documented.

In Table 3, Description of the system boundary, all declared modules shall be indicated with an “X”.

**Table 2
Description of system boundary**

Product Stage			Construction Process Stage		Use Stage							End of Life Stage			
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
----- Cradle-to-grave -----															
Cradle-to-gate			----- w/ options -----												



Any site-generated energy and purchased electricity shall be included in the system boundary. The extraction, processing, and delivery of purchased primary fuels, shall also be included. Regionally specific inventory data on electricity shall be based on subnational U.S. and/or Canadian consumption mixes that account for power trade between regions using the latest electricity grid data available. If such regional data are not available, a dataset for the specific electricity grid for that plant may be used or the production mixes of the three continental interconnections (East, West, Texas) as well as those of Hawaii and Alaska may be used.

7.1.7 System boundaries and technical information scenarios

7.1.7.1 General

Information for modules A1 to A3 is mandatory for all types of EPDs. Additional information shall be reported for all declared modules. Other general comments pertaining to information for modules is presented in ISO 21930:2017 Section 7.1.7.1. Figure 1 shows the life-cycle stages and individual modules included within the LCA system boundary.

Construction works assessment information														
Construction works life cycle information within the system boundary											Optional supplementary information beyond the system boundary			
A1 - A3 PRODUCTION Stage (Mandatory)			A4 - A5 CONSTRUCTION Stage		B1 - B7 USE Stage					C1 - C4 END-OF-LIFE Stage			D	
A1	A2	A3	A4	A5	B1	B2	B3	B4 ^a	B5	C1	C2	C3	C4	D
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance (incl. production, transport and disposal of necessary materials)	Repair (incl. production, transport and disposal of necessary materials)	Replacement (incl. production, transport and disposal of necessary materials)	Refurbishment (incl. production, transport and disposal of necessary materials)	De-construction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste	Potential net benefits from reuse, recycling and/or energy recovery beyond the system boundary
			Scenario	Scenario	Scenario	Scenario	Scenario	Scenario	Scenario	Scenario	Scenario	Scenario	Scenario	Scenario
					B6 Operational energy use									
					Scenario									
					B7 Operational water use									
					Scenario									

^a Replacement information module (B4) not applicable at the product level.

Figure 1
Common four life cycle stages and their information modules [Source: 21930:2017]

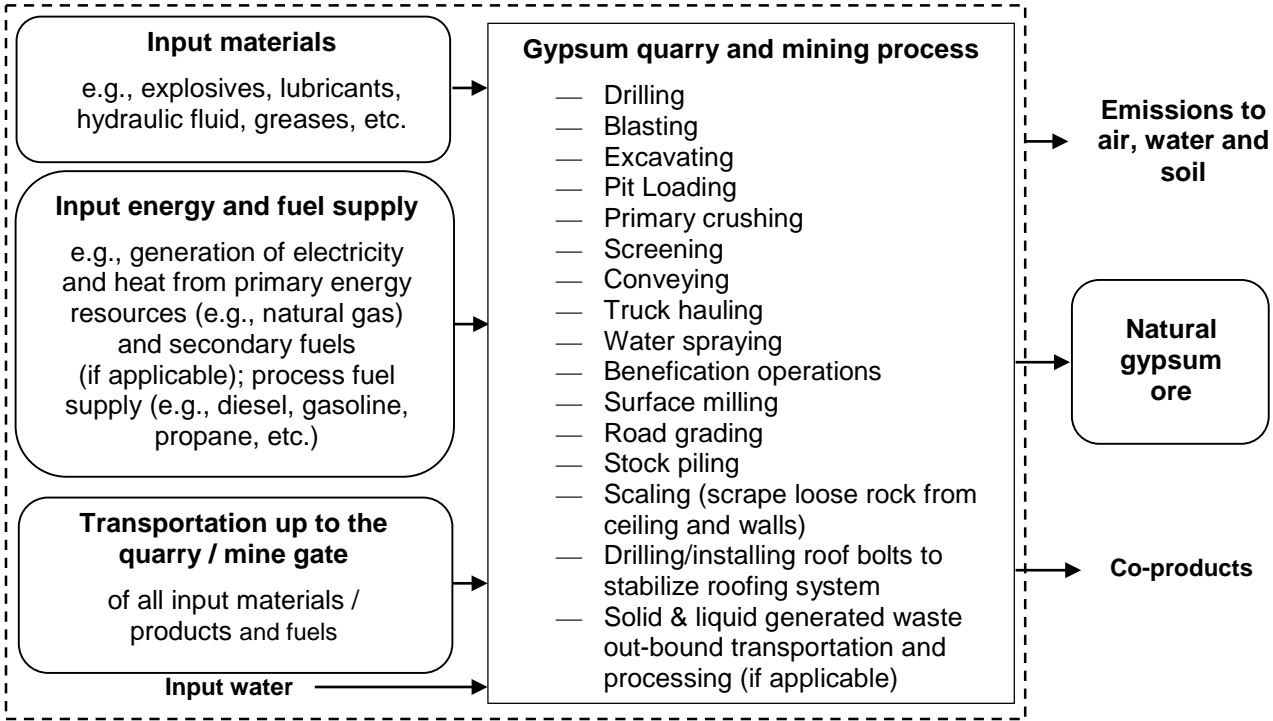


Figure 2
Cradle-to-gate system boundaries of the gypsum quarry and mining process

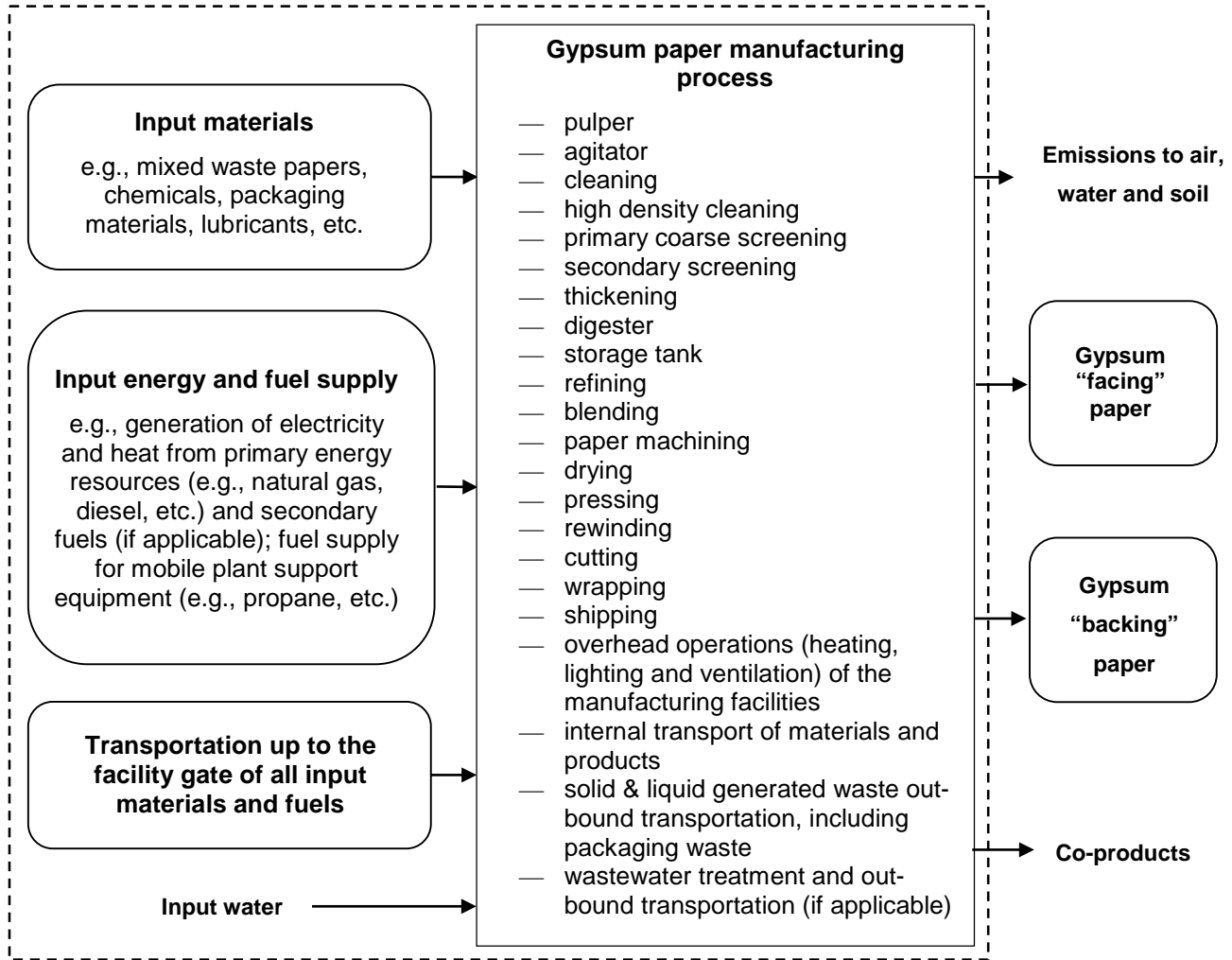


Figure 3
Cradle-to-gate system boundaries of gypsum paper manufacturing

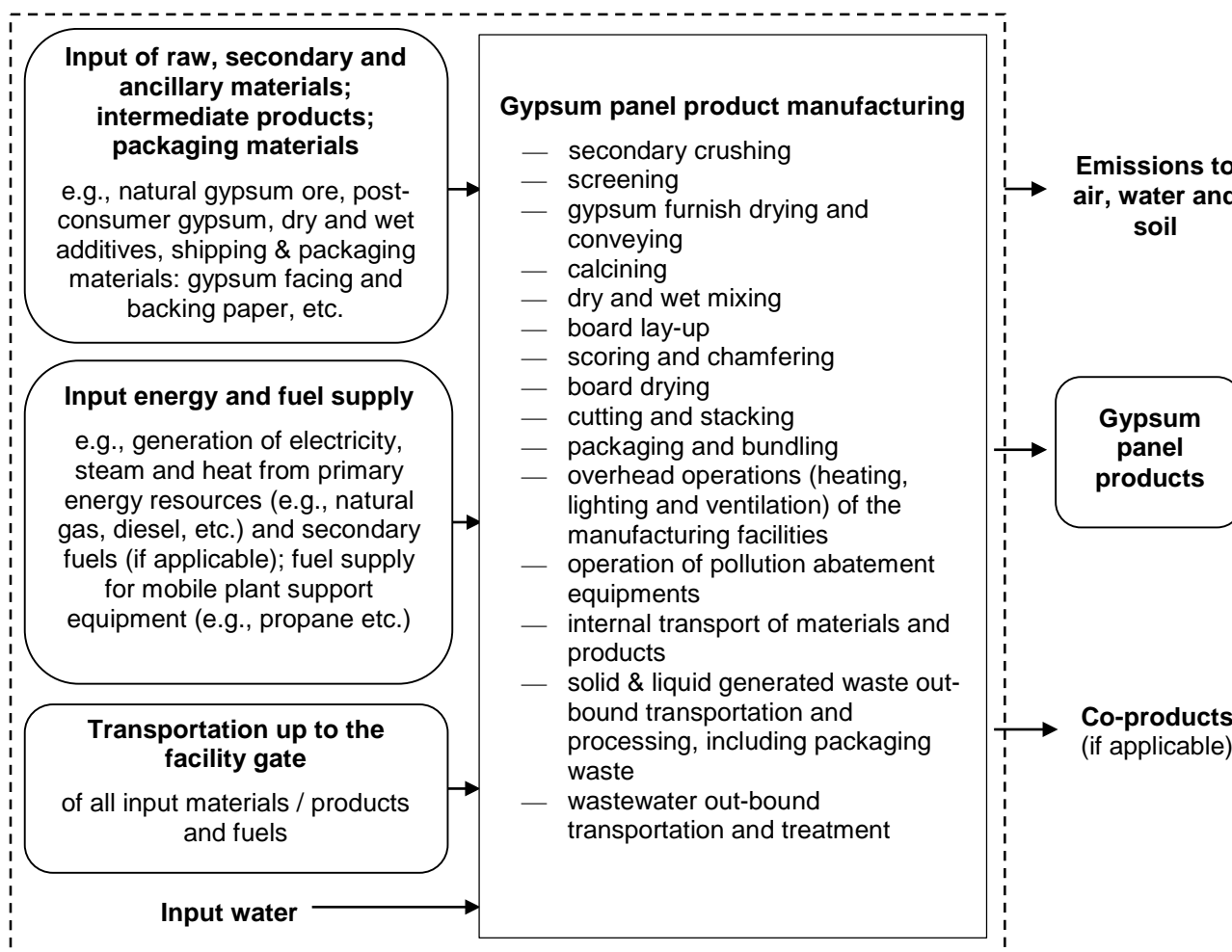


Figure 4
Cradle-to-gate system boundaries of gypsum panel product manufacturing



7.1.7.2 A1-A3, production stage

7.1.7.2.1 General

Per ISO 21930 Section 7.1.7.2.1.

NOTE — this includes upstream manufacturing of raw materials for gypsum panel products.

7.1.7.2.2 A1, extraction and upstream production

Per 21930 Section 7.1.7.2.2.

7.1.7.2.3 A2, transport to factory

Per 21930 Section 7.1.7.2.3, with the following clarification:

This information module includes:

- average or specific transportation of raw materials (including recycled materials) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process) and including empty backhauls and transportation to interim distribution centers or terminals. In the absence of specific transportation data, the default value of 500 miles (800 km) shall be used.

7.1.7.2.4 A3, manufacturing

Per ISO 21930 Section 7.1.7.2.4, with the following additions:

The information module “manufacturing” includes:

- packaging, including transportation and waste disposal, to make product ready for shipment;
- if packaging is purchased from multiple suppliers, then a weighted average of the transportation distances by mode from all suppliers may be used in the LCA modeling;



- average or specific transportation from manufacturing site to recycling/reuse/landfill for pre-consumer wastes and unutilized by-products from manufacturing, including empty backhauls;
- recycling/reuse/energy recovery of pre-consumer wastes and by-products from production; and
- treatments of flue gas desulfurization (FGD) gypsum to make it usable as a product input.

7.1.7.2.5 Input of secondary materials or recovered energy

Per ISO 21930 Section 7.1.7.2.5, with the following addition:

In the case of FGD gypsum, it is used without burden but does include all treatments necessary to make it usable as a product input.

7.1.7.2.6 Co-products leaving the system

Per ISO 21930 Section 7.1.7.2.6.

7.1.7.2.7 Output of waste

Per ISO 21930 Section 7.1.7.2.7.

7.1.7.2.8 End-of-life scenarios for packaging

Per ISO 21930 Section 7.1.7.2.8.

7.1.7.3 A4-A5, Construction stage

7.1.7.3.1 General

Per ISO 21930 Section 7.1.7.3.1.



7.1.7.3.2 A4, transport to site

Per ISO 21930 Section 7.1.7.3.2, with the following additions:

A4, transportation to the construction site:

- if relevant, the transportation from the factory gate to the central warehouse or intermediate distribution site shall be included. Transport to the construction site is also included. Transport distances should be as specific as possible. If specific transportation data is not available, the following values should be used:
 - average distribution mileage of gypsum panel products from the manufacturing gate to the distribution center gate shall be 448 km (280 miles) by commercial tractor-trailer truck and 208 km (130 miles) by rail; and
 - final transportation from the distribution gate to the construction site is defaulted to 40 km (25 miles) by a single unit truck with an empty backhaul. Transport distance should be as specific as possible. The distance to the construction site may be estimated based on weighted average distance to the market of the product.
- any exceptions to these modes and mileages shall be justified in the LCA report and noted in the EPD.



**Table 3
Transportation Scenario Information**

Information	Unit	Value
Type of transport		
Type of vehicle		
Distance	km	
Fuel type		
Amount of fuel	liters	

7.1.7.3.3 A5, installation

Per ISO 21930 Section 7.1.7.3.3, with the following additions:

- the default on-site installation waste scenario for all gypsum panel products shall be 10% on a surface area basis of product. Any exceptions shall be justified in the project LCA report and noted in the EPD;
- for interior gypsum panel products, the ancillary materials required for installation shall include fasteners, joint tape and joint compound. The amount of joint compound used during installation shall adhere to the PCR for joint compound;
- for exterior gypsum panel products, the ancillary materials required for installation shall include fasteners;
- any packaging waste should be included in this module, including mass, type, and biogenic carbon content of packaging if relevant; and



- based on normal North American gypsum products industry practices, this PCR supports the scenario that all gypsum panel installation waste shall be disposed in an appropriate construction and demolition landfill. Alternate scenarios for installation waste handling shall be justified in the project LCA report and noted in the EPD.

**Table 5
Packaging waste scenario information**

Information	Unit	Value
Mass of packaging waste	kg	
Type of packaging waste		
Biogenic carbon content of packaging (where relevant)	kg CO ₂ eq	



**Table 6
Installation scenario information**

Information	Unit	Value
Product loss	kg	
Ancillary materials	kg	
Electricity consumption	kWh	
Other energy consumption	kWh	
Water consumption (including source, amount, and fate)	m ³	
Direct emissions to ambient air, soil, and water	kg	
Waste materials as output from installation process	kg	

7.1.7.3.4 End-of-life scenarios for packaging

Per ISO 21930 Section 7.1.7.3.4.



7.1.7.4 Use stage

7.1.7.4.1 General

Per ISO 21930 Section 7.1.7.4.1.

7.1.7.4.2 B1-B5, use stage (related to the use of construction products)

7.1.7.4.2.1 General

Per ISO 21930 Section 7.1.7.4.2.1, with the following additions:

The RSL of the product and the ESL of the building are assumed to be 75 years. The maintenance, repair, replacement, and refurbishment regimes shall be declared accordingly and modeled according to the manufacturer guidelines regarding the life of the product based on verifiable product performance history. Gypsum panel products are assumed to require no maintenance, repair, replacement or refurbishment during phases B1-B5.

7.1.7.4.2.2 B1, use or application of the installed product

Per ISO 21930 Section 7.1.7.4.2.2, with the following clarification:

7.1.7.4.2.3 B2, maintenance

Gypsum panel products are assumed to have no material or energy inputs or emissions during this phase.

7.1.7.4.2.4 B3, repair

Gypsum panel products are assumed to have no material or energy inputs or emissions during this phase.

7.1.7.4.2.5 B4, replacement

Gypsum panel products are assumed to have no material or energy inputs or emissions during this phase.



7.1.7.4.2.6 B5, refurbishment

Gypsum panel products are assumed to have no material or energy inputs or emissions during this phase.

7.1.7.4.3 B6-B7, use stage, informational modules related to the operation of the construction works

7.1.7.4.3.1 General

Per ISO 21930 Section 7.1.7.4.3.1.

7.1.7.4.3.2 B6, operational energy use

Gypsum panel products are assumed to have no operational energy use during the use phase of the product.

7.1.7.4.3.3 B7, operational water use

Gypsum panel products are assumed to have no operational energy use during the use phase of the product.

7.1.7.5 C1-C4, end-of-life stage

Per ISO 21930 Section 7.1.7.5, with the following additions:

Based on the normal North American gypsum panel products industry practices, this PCR supports the scenario that all gypsum panel products shall be disposed in an appropriate construction and demolition landfill at the end of life.

— C1 – Deconstruction / demolition:

- shall include the energy required for gypsum panel product deconstruction including demolition and released dust in the air.



- C2 – End-of-life transportation:
 - shall include the transportation of gypsum panel waste from the building to landfill site.
- C3 – Waste processing:
 - shall be assumed that no gypsum panel waste goes to waste processing facility prior to disposal in landfill.
- C4 – Waste disposal:
 - shall be assumed to be disposed in an appropriate construction and demolition landfill.

Any scenario not following the above assumptions for end-of-life of gypsum panel products must be documented and justified.

7.1.7.6 Benefits and loads beyond the system boundary in optional supplemental module D

Per ISO 21930 Section 7.1.7.6.

7.1.8 Criteria for the inclusion and exclusion of inputs and outputs

Per ISO 21930 Section 7.1.8.

7.1.9 Selection of data and data quality requirements

Per ISO 21930 Section 7.1.9, with the following additions:

Specific data derived from specific production processes shall be the first choice as a basis for calculating an EPD. National databases shall be used for upstream data to the extent that they are applicable, and no other primary data is available. If appropriate national data are not available, sources for similar technology adjusted for national



boundary conditions may be used. Data from other regions are acceptable if it is determined and justified that those data are the best available.

All data sources shall be specified, including source database and year of publication. Sources of data for transport models (including transport mode, distances, and quantities to be transported) and thermal energy production shall be documented. Where proxy data are used in the absence of specific data for chemicals or other inputs, the source and justification for selection of the proxies shall be documented in the LCA report.

Any secondary data source used in the underlying life-cycle inventory shall be complete and representative of the applicable North American region in terms of its geographic and technological coverages and of a recent vintage, which is less than ten years old. Any deviation from these requirements for secondary data shall be documented and the following apply:

- all data shall be accurate and representative of the production process, current technology, and current measurement capability;
- data shall be identified as direct, indirect, estimated, or other;
- the data shall be representative according to temporal, geographical, and technological requirements;
- temporal – The obtained information from the manufacturing process shall be annual values, preferably from the previous twelve-month period or calendar year, unless accompanied by a statement attesting to the validity of older data. Average background or secondary data shall not be older than ten years unless accompanied by a statement attesting to the validity of older data;
- geographical – The geographic region of the relevant life-cycle stages included in the calculation of representative data shall be documented;
- technological – The data shall represent technology in use;
- the following specific or proxy background data shall be documented with regard to data sources:
 - extraction and/or production of raw materials (specific or average background); manufacturing of the product;
 - the fuel mix and calculation procedures for electricity generation;
 - hazardous waste according to applicable U.S. and/or Canadian federal or state/provincial regulations (or appropriate regulations for materials imported from outside North America);
 - data for upstream products where specific or proxy data is not available (e.g. glass mat); and



- weighted averages based on volume or mass used to assign transport distance and mode if multiple suppliers are used for one material.

In the case of cradle-to-grave EPDs, the amount of material used as input to enable the product to meet the functional unit requirements shall include related accessories and other materials (that is, ancillary materials) unless the reason for the omission of these is explained.

7.1.10 Units

Per ISO 21930 Section 7.1.10, with the following additions:

SI units shall be used for the LCA results, with conversions shown in the table below as necessary. Other units commonly used in the market may be included in addition to the required SI units. The preferred power and energy units are as follows:

- kWh or MJ for electric energy; and
- kW or MW for power.



**Table 7
Conversion factors**

Convert from	To	Multiply by
Square meter (m ²)	Square foot (ft ²)	1.076391E+01
Kilogram (kg)	Pound (lb)	2.204622
Mega joule (MJ)	British Thermal Unit (Btu)	9.478170E+02
Degree Celsius (°C)	Degree Fahrenheit (°F)	(°C * 9/5) +32
Cubic meter (m ³)	Cubic foot (ft ³)	3.531466E+01
Meter (m)	Foot (ft)	3.281
m ² K/W	ft ² Fhr/Btu	5.6783
Metric ton	Ton	1.102

7.2 Inventory analysis

7.2.1 Data Collection

Per ISO 21930 Section 7.2.1.



7.2.2 Calculation procedures

Per ISO 21930 Section 7.2.2.

7.2.3 – 7.2.6 Allocation

Per ISO 21930 Section 7.2.3 – 7.2.6, with the following additions:

In a production process in which more than one type of product is generated, it is necessary to allocate the environmental flows (inputs and outputs) from the process to the different products to get product-based inventory data. Allocation, if required, shall follow the requirements and guidance of ISO 14044:2006, Section 4.3.4 and shall be based on the mass of gypsum panel products produced. Allocation related to transport shall be based on the mass of the transported product.

If different allocation options are relevant and a deviation of greater than 20% is a foreseen outcome, a sensitivity analysis shall be completed. These different allocation approaches and data sets shall be documented and declared.

FGD gypsum, a co-product of the coal-fired power generation process, is a significant input used in the manufacture of NA gypsum panels. FGD gypsum is treated as a waste material of the coal-fired power generate process. The system boundary for NA gypsum panel products does not include the production of electricity from coal-fired power plants that produces the FGD gypsum. Therefore, FGD gypsum is considered a waste material input to the product system. FGD gypsum is considered burden free as it is not a primary material of the coal-fired power generation and a waste input into the NA gypsum panel manufacturing process.

7.2.7 Accounting of biogenic carbon uptake and emission during the life cycle

Per ISO 21930 Section 7.2.7, with the following clarification:

For the production of gypsum panel products, recycled raw materials used to produce paper are not counted as biogenic carbon whereas starch and dextrose are counted.



For the production of gypsum panel products, only starch and dextrose are counted as biogenic carbon emissions.

The following indicators on the uptake and emissions of biogenic carbon shall be separately reported, where relevant and available, if included in the quantification of the GWP:

**Table 8
Biogenic carbon indicators**

Parameter	Unit
Biogenic CO ₂ removal and emissions associated with bio-based products	kg CO ₂ eq.
Biogenic CO ₂ removal and emissions associated with bio-based packaging	kg CO ₂ eq.
CO ₂ from calcination and carbonation (emissions and uptake of CO ₂ from calcination and carbonation)	kg CO ₂ eq.
Biogenic CO ₂ emissions from combustion of waste from renewable sources used in production	kg CO ₂ eq.
CO ₂ emissions from combustion of waste from non-renewable sources used in production	kg CO ₂ eq.

7.2.8 Carbonation

Per ISO 21930 Section 7.2.8

7.2.9 Accounting of delayed emissions

Per ISO 21930 Section 7.2.9



7.2.10 Inventory indicators describing resource use

Per ISO 21930 Section 7.2.10, with the following additions:

The use of renewable and non-renewable primary resources (energy and materials), and the use of secondary resources (secondary materials, secondary fuels, and recovered energy), shall be declared in the EPD. The data for reporting these indicators is derived from the LCI. The following indicators shall be reported separately.

NOTE – ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017 (available at www.aclca.org).



**Table 9
Resource indicators**

Parameter	Unit
RPR _E : Renewable primary energy used as energy carrier (fuel)	MJ
RPR _M : Renewable primary resources with energy content used as material	MJ
NRPR _E : Non-renewable primary resources used as an energy carrier (fuel)	MJ
NRPR _M : Non-renewable primary resources with energy content used as material	MJ
SM: Secondary materials	kg
RSF: Renewable secondary fuels	MJ
NRSF: Non-renewable secondary fuels	MJ
RE: Recovered energy	MJ
FW: Use of net fresh water resources	m ³
Abiotic depletion potential (ADP)	MJ



7.2.11 Greenhouse gas emissions from land-use change

Per ISO 21930 Section 7.2.11.

7.2.12 Additional inventory indicators describing emissions and removals of carbon

Per ISO 21930 Section 7.2.12.

7.2.13 Inventory indicator describing consumption of freshwater

Per ISO 21930 Section 7.2.13.

7.2.14 Environmental information describing waste categories and output flows

Per ISO 21930 Section 7.2.14.

7.3 Impact assessment indicators describing main environmental impacts derived from LCA

Per ISO 21930 Section 7.3, and ISO 14044 with the following additions:

All environmental impacts are to be declared in the life cycle stage in which they occur. As this PCR applies only for gypsum panel products for use in North American or export markets, only the North American specific characterization method, TRACI 2.1, indicated in ISO 21930:2017 will be required.

For the purposes of this PCR, TRACI characterization factors are to be utilized. Values reported for GWP are based on accumulated radiative forcing over 100 years.

A statement shall be included that the LCIA results are relative expressions and do not predict impacts on category endpoints, the exceedance of thresholds, safety margins, or risks.



**Table 10
Impact Categories**

Impact Category and Abbreviation	Unit
Global warming potential (GWP 100)	kg CO ₂ equiv.
Ozone depletion potential (O ₃ DP)	kg CFC-11 equiv.
Eutrophication potential (EP)	kg N equiv.
Acidification potential (AP)	Kg SO ₂ equiv.
Photochemical oxidant creation potential (POCP)	kg O ₃ equiv.



8 ADDITIONAL ENVIRONMENTAL INFORMATION

Per ISO 21930 Section 8, with the following:

Environmental information related to the product manufacture that extends beyond this PCR may be described, such as reference to environmental management systems or other programs.



9 CONTENT OF AN EPD

9.1 General

Per ISO 21930 Section 9.1.

9.2 Declaration of general information

Per ISO 21930 Section 9.2, with the following additions:

The EPD shall include:

- demonstration of third-party verification, as shown below in Figure 5:

<p>ISO 21930:<insert year of publication>— serves as the core PCR</p> <p><Sub-category PCR, if relevant></p> <p><PCR review^{a,b,c} was conducted by:></p> <p><Sub-category PCR review^{ade} was conducted by:></p> <p><name and organization of the panel chair, and their contact information^f></p>
<p>Independent verification of the declaration and data, according to ISO 21930: <insert year of publication> and ISO 14025: <insert year of publication></p> <p><input type="checkbox"/> internal <input type="checkbox"/> external</p>
<p>Third party verifier^g:</p> <p><Name of the third party verifier></p>

Figure 5
Demonstration of verification [Source: ISO 21930:2017 Section 9.2]



The product content shall be described in the declaration. Product specific data that is confidential because of the competitive business environment, intellectual property rights, or similar legal restrictions need not be specifically declared. In such cases, a notation that the information is confidential shall be made along with a description of the function of the component.

The EPD shall provide a narrative description of the product that will enable the user to clearly and unambiguously identify the product. This description shall include, where relevant:

- product identification by brand name, material type, and simple visual representation, which may be by photograph or graphic illustration;
- list of the standards and other product specifications to which the products comply;
- details regarding reinforcement, thicknesses and colors;
- flow diagram illustrating main unit processes by life-cycle stage according to the scope of the declaration;
- materials and substances to be declared; and
- any additional information that will assist in identifying the product.

Material contents of the finished product, including packaging, shall be declared in terms of the main components. Intentionally added substances officially classified as hazardous according to relevant national or international regulations shall be stated. Product specific data that is confidential because of the competitive business environment, intellectual property rights, or similar legal restrictions need not be declared except where such data involves regulated hazardous substances, which must always be disclosed.

9.3 Declaration of methodological framework

Per ISO 21930 Section 9.3.

9.4 Declaration of technical information and scenarios

9.4.1 General

Per ISO 21930 Section 9.4.1.



9.4.2 Transportation (after gate)

Per ISO 21930 Section 9.4.2, with the following additions:

For module A4, Transportation from the manufacturing gate to the building site, the default average distribution mileage of gypsum panel products from the manufacturing gate to the distribution center gate shall be 448 km (280 miles) by commercial tractor-trailer truck and 208 km (130 miles) by rail. Final transportation from the distribution gate to the construction site is defaulted to 40 km (25 miles) by a single unit truck with an empty backhaul. Any exceptions to these modes and mileages shall be justified in the LCA report and noted in the EPD.

9.4.3 Installation (A5)

Per ISO 21930 Section 9.4.3, with the following additions:

A description of the installation process, including ancillary materials for installation specified by type and amount. For interior gypsum panel products, the ancillary materials required for installation shall include fasteners, joint tape and joint compound. The amount of joint compound used during installation shall adhere to the PCR for joint compound. For exterior gypsum panel products, the ancillary materials required for installation shall include fasteners.

The default on-site installation waste scenario for all gypsum panel products shall be 10% on a surface area basis of product.

Any packaging waste should be included in this module

Based on normal North American gypsum products industry practices, this PCR supports the scenario that all gypsum panel installation waste shall be disposed in an appropriate construction and demolition landfill. Alternate scenarios for installation waste handling shall be justified in the project LCA report and noted in the EPD.



9.4.4 Use stage (B1-B5)

Per ISO 21930 Section 9.4.4, with the following additions:

The RSL of the product and the ESL of the building shall be assumed to be 75 years and the maintenance regime and number of replacements, if relevant, of the building product shall be declared accordingly (note that an assumed 75-year RSL for the building is an accepted time period for the purpose of comparative analysis);

**Table 11
Use stage (B1-B5) scenario information**

Module		Maintenance (B2)	Repair (B3)	Replacement (B4)	Refurbishment (B5)
RSL cycle	Number/ RSL				
ESL cycle	Number/ RSL				
Ancillary materials	kg				
Energy input	kWh				
Water input	m ³				
Waste materials	kg				
Direct emissions	kg				



9.4.5 Use Stage (B6-B7)

Per ISO 21930 Section 9.4.5, with the following clarification:

Gypsum panel products are assumed to have no operational energy or water use during the use phase of the product.

**Table 12
Use Stage (B6-B7) Scenario Information**

Information	Unit	Value
Operational energy use	kg	0
Operational water use	m ³	0

9.4.6 End-of-life (C1-C4)

Per ISO 21930 Section 9.4.6, with the following clarification:

Based on the normal North American gypsum panel products industry practices, this PCR supports the scenario that all gypsum panel products shall be disposed in an appropriate construction and demolition landfill at the end of life.

A description of the deconstruction or demolition of the product shall include any energy required and any release of dust into the air.

Transportation of the gypsum panel waste from the building to the landfill. In the absence of specific waste transportation data, the default value of 50 miles (80 Km) shall be used.

This PCR assumes that no gypsum panel waste goes to waste processing facility prior to disposal in landfill.



The amount of gypsum panel board disposed of in the appropriate assumed construction and demolition landfill shall be indicated in kg per functional or declared unit.

9.4.7 Module D

Per ISO 21930 Section 9.4.7.

9.5 Declaration of environmental indicators derived from LCA

9.5.1 LCA results from LCIA

Per ISO 21930 Section 9.5.1.

9.5.2 LCA results from LCI

Per ISO 21930 Section 9.5.2.

9.6 Declaration of additional environmental information

Per ISO 21930 Section 9.6, with the following additions:

All significant aspects related to the product life cycle should be considered in the LCA. Those aspects not covered by the LCA shall be reported in the EPD as additional environmental information. This information may be qualitative or quantitative, such as reference to environmental management systems or other programs and shall be verifiable and comply with the requirements in ISO 14025:2006.

A short interpretation of the results should be included, as well as a statement of possible limitation of the results. Instructions and limits for the correct use of the EPD and results may be included.



10 PROJECT REPORT

10.1 General

Per ISO 21930 Section 10.1, with the following additions:

The Project Report shall include LCA based information described in Section 3 and additional information specified in this document. It shall contain any data and information of importance to the results in the EPD and as required by this document. The report shall include a transparent demonstration that the data and information in the EPD results from the LCA study. The report shall also include a transparent description of how the RSL was established (if relevant to the system boundaries).

The project report must be made available to the verifier under the requirements of confidentiality stated in ISO 14025, but the project report is not part of the public communication.

10.2 LCA-Related elements of the project report

Per ISO 21930 Section 10.2.

10.3 Data confidentiality

Per ISO 21930 Section 10.3.

10.4 Documentation on additional environmental information

Per ISO 21930 Section 10.4.

10.5 Data availability for verification

Per ISO 21930 Section 10.5.



11 VERIFICATION AND VALIDITY

Per ISO 21930 Section 11.



12 REFERENCES

The development of this PCR included consideration and reference to the following PCRs:

- *Product Category Rules for Preparing an Environmental Product Declaration for North American Gypsum Boards*; FPIInnovations – Gypsum PCR-2013: v1
- *Product Category Rules for Preparing an Environmental Product Declaration for North American Glass Mat Gypsum Panels*; ASTM-2016

ASTM Standards:¹

- ASTM C11 – 18b *Standard terminology relating to gypsum and related building materials and systems*
- ASTM C22 – 00(15) *Standard Specification for Gypsum*
- ASTM E2921 – 16a *Standard practice for minimum criteria for comparing whole building LCAs for use with building codes, standards, and rating systems*

ISO Standards:²

- ISO 6707-1:2017 *Buildings and civil engineering works – Vocabulary – Part 1: General terms*
- ISO 14025:2006 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*
- ISO 14040:2006 *Environmental management – Life cycle assessment – Principles and framework*
- ISO 14044:2006 *Environmental management – Life cycle assessment – Requirements and guidelines*
- ISO 14050:2009 *Environmental management – Vocabulary*

¹ Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. <www.astm.org>.

² Available from International Organization for Standardization. Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland. <www.iso.org>



PCR for Gypsum Panel Products

- ISO 15686-1:2011 *Environmental management – Life cycle assessment – Requirements and guidelines*
- ISO 21930:2017 *Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services*

Other references:

- ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2018, *International green construction code*. Available from <https://www.ashrae.org/technical-resources/bookstore/standard-189-1>
- American Center for Life Cycle Assessment. 21930:2017 guidance available at <https://aclca.org/>
- ULE PCR *Guidance for building-related products and services – Part B: Joint compound EPD requirements*. Available at https://industries.ul.com/wp.../sites/.../ULE_PCR_Part_B_Joint_Compound_v12-2.pdf

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THE HOPE OF MANKIND rests in the ability of man to define and seek out the environment which will permit him to live with fellow creatures of the earth, in health, in peace, and in mutual respect.