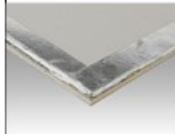
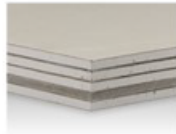


An Environmental Product Declaration

According to ISO 14025:2006 and ISO 21930:2017

A cradle-to-gate EPD covering PABCO® Gypsum's QuietRock® Product line¹.

This EPD has been prepared in conformance with ISO 14040/44 standards [3], [4], and according to the requirements of NSF International product category rules (PCR) for preparing an environmental product declaration for gypsum panel products [5], ISO 21930 [6], and ASTM International's EPD program operator rules [15]. This EPD was commissioned by PABCO® Gypsum and is verified by ASTM International to conform to the requirements of ISO 14040 [3], 14044 [4], 14025 [7], and 21930 [6].

QuietRock® EZ-SNAP	QuietRock® EZ-SNAP Mold Resistant	QuietRock® 500/510	QuietRock® 530	QuietRock® 530 RF	QuietRock® 545
					
Type X, 5/8" sound damping gypsum panel <i>without paper or metal in the core</i> . Cuts and installs similar to regular gypsum panel products. QuietRock® ES is the professional's choice for acoustic walls in residential and commercial applications.	Mold resistant, Type X, 5/8" sound damping gypsum panel <i>without paper or metal in the core</i> . Cuts and installs similar to standard gypsum panel products. QuietRock® ES Mold Resistant is recommended for mold sensitive applications such as schools, hospitals, and government projects	1/2" low cost sound damping gypsum panel – ideal for installation in residential and remodeling applications. Installs similar to standard gypsum panels, no special tools required	QuietRock® 530 is a fire rated, 5/8" impact resistant sound damping gypsum panel <i>equipped with a thin layer of steel in the center</i> .	QuietRock® 530 RF is used in construction of high security environments such as Sensitive Compartmented Information Facilities (SCIF) and government offices for <i>both radio frequency (RF) and acoustic frequency (AF) transmission mitigation</i> .	QuietRock® 545 is the only sound damping panel that is designed for <i>maximum sound isolation</i> across a broad frequency range. QuietRock® 545 is ideal for high-end home theaters, commercial studios, music rooms, and other projects where low-frequency mitigation is critical.

¹ <https://www.quietrock.com>

Environmental Product Declaration Summary

General Summary	
Owner of the EPD	
 PABCO® Gypsum what the job demands®	PABCO® Gypsum 10600 White Rock Road, Bldg. A, Suite 150 Rancho Cordova, CA 95670 USA Weblink (URL): http://www.pabcogypsum.com/
Product Group and Name	QuietRock® Laminated Gypsum Panel Products QuietRock® EZ-SNAP (Type X, 15.9 mm) QuietRock® EZ-SNAP Mold Resistant (Type X, 15.9 mm) QuietRock® 500/510 (Regular, 12.7 mm) QuietRock® 530 (Type X, 15.9 mm) QuietRock® 530 RF (Type X, 15.9 mm) QuietRock® 545 (Regular, 34.925 mm)
Product Description	QuietRock® gypsum panels are comprised of two or more gypsum core laminations with or without a metal core material. They are developed with patented "thin wall technologies" to improve Sound Transmission Class (STC) and thus, offer improved acoustic performance.
Product Category Rules (PCR)	NSF International, Product Category Rule for Environmental Product Declarations, PCR for Gypsum Panel Products, April 2020 [5].
Declared Unit	92.9 m ² (1,000 square feet (MSF))
Certification Period	09.04.2020 – 09.04.2025 (extended to March 4, 2026)

EPD and Project Report Information			
Program Operator		ASTM International	
Declaration Holder		PABCO® Gypsum	
Product group	Date of Issue	Period of Validity	Declaration Number
QuietRock® gypsum panels	September 4, 2020	5 years (extended to March 4, 2026)	EPD #156
Declaration Type A “cradle-to-gate” EPD for QuietRock® gypsum panels manufactured by PABCO® Gypsum. Activity stages or information modules covered include production with the product ready for shipment at the manufacturing plant (modules A1 to A3). The declaration is intended for use in Business-to-Business (B-to-B) communication.			
Applicable Countries United States and Canada			
Product Applicability QuietRock® sound reducing drywall offers outstanding acoustic performance and can exceed STC requirements for most wall applications. QuietRock® products range from 1/2", 5/8", and 1-3/8" thicknesses, providing options for specific design and acoustic performance.			
Content of the Declaration This declaration follows <i>Section 9; Content of an EPD</i> , NSF International, Product Category Rule for Environmental Product Declarations: PCR for Gypsum Panel Products, April 2020 [5].			
This EPD was independently verified by ASTM in accordance with ISO 14025 and the reference PCR: Internal <u>External</u> X		Tim Brooke ASTM International 100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA 19428-2959, USA 	
The Project Report		A Cradle-to-Gate Life Cycle Assessment of PABCO® Gypsum’s QuietRock® Product Line, August 2020 [14].	
Prepared by  Athena Sustainable Materials Institute		Lindita Bushi, PhD, Mr. Jamie Meil, and Mr. Grant Finlayson Athena Sustainable Materials Institute 280 Albert Street, Suite 404 Ottawa, Ontario, Canada K1P 5G8 info@athenasmi.org www.athenasmi.org	

EPD and Project Report Information

This EPD project report was independently verified by in accordance with ISO 14025, ISO 14040/44, and the reference PCR:

Thomas P. Gloria, PhD.
Industrial Ecology Consultants

PCR Information

Program Operator

NSF Certification, LLC

Reference PCR

NSF International, Product Category Rule for Environmental Product Declarations: PCR for Gypsum Panel Products [5].

Date of Issue

April 2020

PCR review was conducted by:

Thomas P. Gloria, PhD (Chair),
Industrial Ecology Consultants,
Mr. Jack Geibig, EcoForm
Mr. Bill Stough, Sustainable Research Group

1 PRODUCT IDENTIFICATION

1.1 PRODUCT DEFINITION

Per NSF PCR [5], *gypsum panel* product is the general name for a family of sheet products consisting essentially of gypsum [8]. PABCO® Gypsum’s QuietRock® Product line (NAICS Code 327420), is manufactured to ASTM C1396 [1] and ASTM C1766 [2] and are comprised of two or more gypsum core laminations with or without a metal core material. They are developed with patented “thin wall technologies” to improve Sound Transmission Class (STC) and thus, offer improved acoustical performance. QuietRock® Laminated Gypsum Panel Products include:

QuietRock® EZ-SNAP (Type X, 15.9 mm)
QuietRock® EZ-SNAP Mold Resistant (Type X, 15.9 mm)
QuietRock® 500/510 (Regular, 12.7 mm)
QuietRock® 530 (Type X, 15.9 mm)
QuietRock® 530 RF (Type X, 15.9 mm)
QuietRock® 545 (Regular, 34.925 mm)

1.2 PRODUCT STANDARD

Applicable product standards for gypsum panels include:

- ASTM C1396 / C1396M–17- *Standard Specification for Gypsum Board.*
- ASTM C1766-15 (2019) *Standard Specification for Factory-Laminated Gypsum Panel Products.*
- ASTM C11–18b *Standard terminology relating to gypsum and related building materials and systems.*
- ASTM C22 / C22M–00(15) *Standard Specification for Gypsum.*
- ASTM C473–17 *Standard Test Methods for Physical Testing of Gypsum Panel Products.*
- ASTM D3273–16 *Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.*
- ASTM E84–19b *Standard Test Method for Surface Burning Characteristics of Building Materials.*
- ASTM E119–18ce1 *Standard Test Methods for Fire Tests of Building Construction and Materials.*
- ASTM E2921–16a *Standard practice for minimum criteria for comparing whole building LCAs for use with building codes, standards, and rating systems.*

2 DECLARED UNIT

The declared unit is 92.9 m² (1,000 square feet, 1 MSF) of QuietRock® Laminated Gypsum Panel Products (Table 1).

Table 1 Declared unit definition

Product	EZ-SNAP	EZ-SNAP MR	QuietRock® 500/510	QuietRock® 530	QuietRock® 530 RF	QuietRock® 545	Units
Declared unit	92.9	92.9	92.9	92.9	92.9	92.9	m ²
Mass	1202	1202	958	1282	1283	2674	kg
Thickness	15.9	15.9	12.7	15.9	15.9	34.9	mm
Core type	QRES/ Type X	QRES/ Type X	QR510/ Regular	QR530/ Type X	QR530/ Type X	QR545/ Regular	n/a

3 MATERIAL CONTENT

Table 2 below presents the composition (in %) by input material for 92.9 m² (1 MSF) of each of the products comprising the QuietRock® family of products.

Table 2: Material content for 92.9 m² (1 MSF) of QuietRock® gypsum panels

Inputs	EZ-SNAP	EZ-SNAP MR	QuietRock® 500/510	QuietRock® 530	QuietRock® 530 RF	QuietRock® 545
Gypsum core board	98%	98%	98%	80%	80%	70%
Thin layer of steel	0%	0%	0%	17%	17%	8%
MgO board	0%	0%	0%	0%	0%	19%
Adhesive, tape, glue, fungicide	2%	2%	2%	3%	3%	3%
Total	100%	100%	100%	100%	100%	100%

4 PRODUCT STAGE

For this EPD, the boundary is “cradle-to-gate” or the *Production stage*, which includes extraction of raw materials (cradle) through the manufacture of gypsum boards ready for shipment (gate). Downstream activity stages - Construction, Use, End-of-life, and Optional supplementary information beyond the system boundary - are excluded from the system boundary (Figure 1). Figure 2 illustrates the Production stage system boundary for the declared QuietRock® product line.

PABCO® Gypsum is a highly integrated manufacturer of various types of gypsum board and panel products. It operates a gypsum quarry with an associated wash plant, a gypsum core and board plant, gypsum facing and backing paper plant and a supplementary lamination manufacturing facility that lays up and produces the QuietRock® family of products. In support of the study, primary gate-to-gate LCI data were collected from all these sites and facility operations for the reference year 2017.

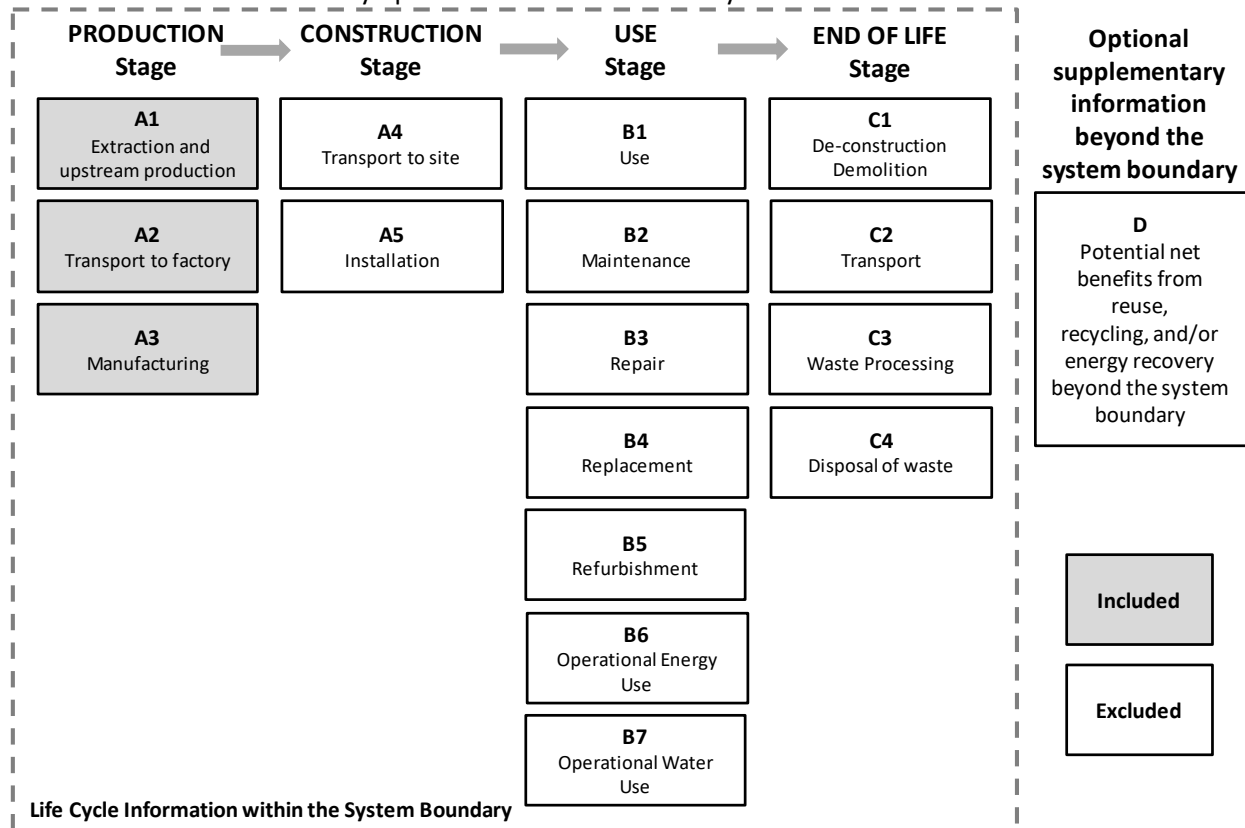


Figure 1 Common four life cycle stages and their information modules for construction products and the optional supplementary module [6]

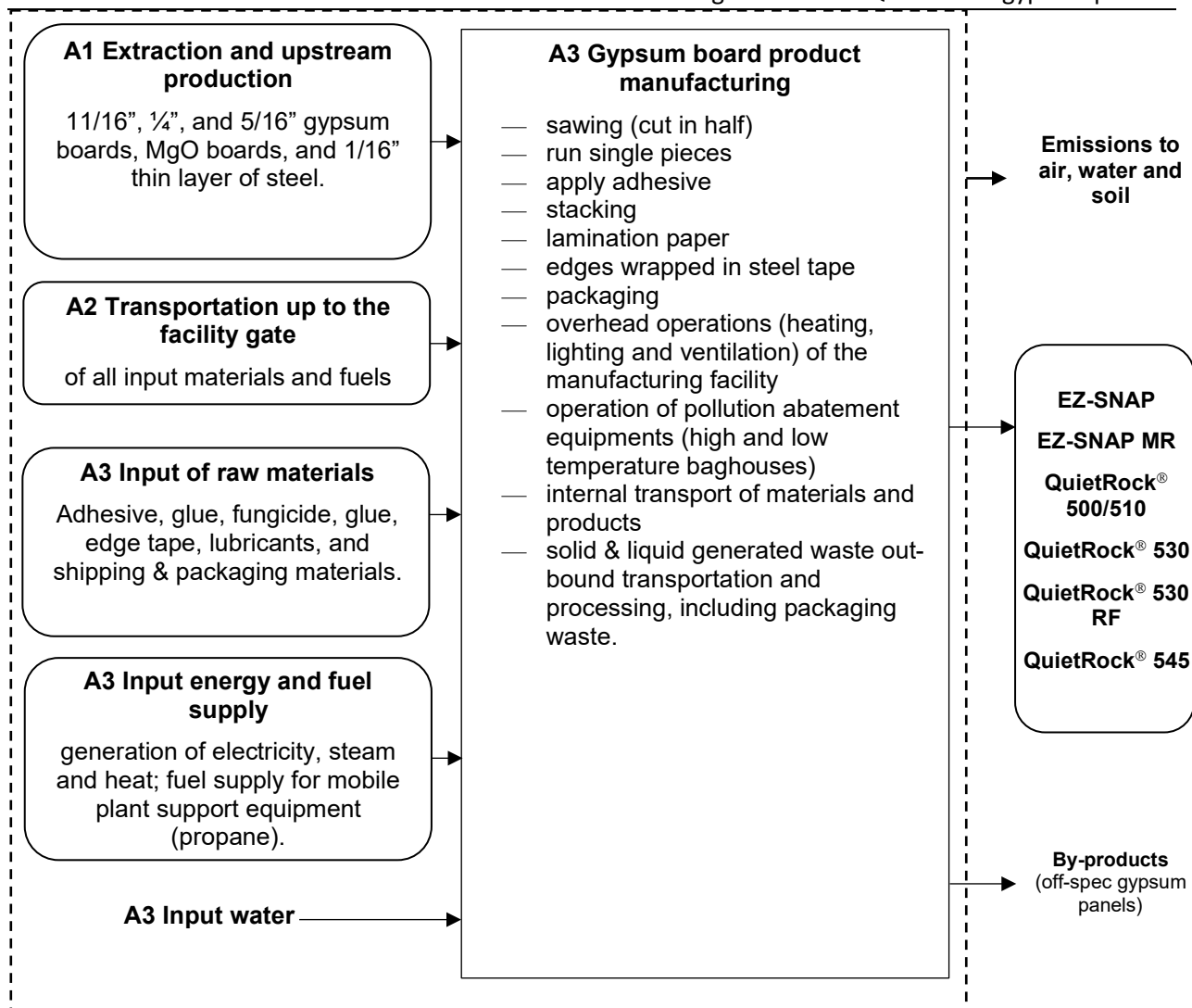


Figure 2 Production stage (modules A1 to A3) system boundary of gypsum panel manufacturing (Newark, CA)

5 LIFE CYCLE INVENTORY

5.1 DATA COLLECTION, SOURCE AND CALCULATIONS

PABCO® provided LCI gate-to-gate data for each of its facilities involved in the manufacture of the QuietRock®. Data were collected for the following sites/facilities for the reference year 2017:

- Quarry and wash plant – Las Vegas, NV
- Gypsum facing/backing papers – Vernon, CA (shipped to Las Vegas, NV)
- Gypsum core fabrication facility (Las Vegas, NV)
- Gypsum panels manufacturing facility (Newark, CA)

LCI data collection was based on four customized LCI surveys for PABCO® Gypsum’s natural gypsum ore extraction site, gypsum paper production, gypsum core fabrication and final QuietRock® panel manufacturing facility.

Source of data is specified as: *Direct*, based on measurements or purchasing/selling records of the surveyed facilities; *Indirect*, based on calculations made by the personnel of the surveyed facilities; and *Estimated*, based on the industry average data and/or expert judgment.

Data calculation procedures follow ISO 14044 [4], and NSF PCR for Gypsum Panel Products [6]. Per ISO 21930, 7.2.2 [6], when transforming the inputs and outputs of combustible material into inputs and outputs of energy, the net calorific value (lower heating value) of fuels is applied according to scientifically based and accepted values specific to the combustible material.

The cradle-to-gate LCI model for each product of interest considers the three modules: A1 Extraction and upstream production, A2 Transport to factory (and between sites) and A3 Manufacturing of each QuietRock® panel product of interest.

5.2 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

A detailed description of collected data and the data quality assessment regarding the NSF PCR requirements [5] and ISO 14044 [4] is provided in the project report [14]. Data quality is assessed based on its representativeness (technology coverage, geographic coverage, time coverage), completeness, consistency, reproducibility, transparency and uncertainty (Table 3).

Table 3 Data Quality Requirements and Assessments

Data Quality Requirements	Description
Technology Coverage	Data represents the prevailing technology in use at PABCO® sites and facilities. Whenever available, for all upstream and core material and processes, North American typical or average industry LCI datasets were utilized. <i>Technological representativeness is characterized as “high”.</i>
Geographic Coverage	The geographic region considered is U.S. The geographic coverage of all LCI databases and datasets is documented in the project report [14]. <i>Geographical representativeness is characterized as “high”.</i>
Time Coverage	Activity data are representative as of 2017 - QuietRock® panels manufacturing process- primary data collected from PABCO® CA facility: reference year 2017 (12 months) - Gypsum core fabrication process- primary data collected from PABCO® NV facility: reference year 2017 (12 months); - In-bound/ out-bound transportation data- primary data collected from PABCO® sites and facilities and accounts for intermediate flows between PABCO® facilities: reference year 2017 (12 months); - Natural gypsum ore – primary data collected from PABCO® NV quarry: reference year 2017 (12 months); - Face and backing paper manufacturing- primary data collected from PABCO® CA paper production facility: reference year 2017 (12 months). - Generic data: the most appropriate LCI datasets were used as found in the US LCI Database, ecoinvent v.3.5 database for US and global, 2018. US LCI database “dummies” (empty/missing LCI datasets) are substituted with ecoinvent v3.5 LCI datasets. <i>Temporal representativeness is characterized as “high”.</i>
Completeness	All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to complete production profile for QuietRock® panel products. The relevant background materials and processes were taken from the US LCI Database (adjusted for known data placeholders), ecoinvent v 3.5 LCI database for US, and modeled in SimaPro software v.9.0.0.30, 2020. The completeness of the cradle-to-gate process chain in terms of process steps is rigorously assessed for all QuietRock® panel products.

Data Quality Requirements	Description
Consistency	To ensure consistency, the LCI modeling of the production input and output LCI data for the gypsum panels product of interest used the same LCI modeling structure across the PABCO® facilities, which consisted of input material and intermediate products, ancillary and packaging materials, energy flows, water resource inputs, product outputs, co-products, by-products, emissions to air, water and soil, and solid and liquid waste disposal. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the facility level and selected process levels to maintain a high level of consistency.
Reproducibility	Internal reproducibility is possible since the data and the models are stored and available in <i>PABCO® Athena QR LCI database</i> developed in SimaPro, 2020. A high level of transparency is provided throughout the project report [14] as the LCI profile is presented for each of the declared products as well as major upstream inputs. Key primary (manufacturer specific) and secondary (generic) LCI data sources are summarized in the project report [14].
Transparency	Activity and LCI datasets are transparently disclosed in the project report [14], including data sources.
Uncertainty	A <i>sensitivity check</i> was conducted to assess the reliability of the EPD results and conclusions by determining how they are affected by uncertainties in the data or assumptions on calculation of LCIA and energy indicator results. The sensitivity check includes the results of the <i>sensitivity analysis</i> and <i>Monte Carlo uncertainty analysis</i> .

5.3 ALLOCATION RULES

Per NSF PCR, Section 7.2.3 and 7.2.6 [6], 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.

PABCO® Gypsum facilities produce other co-products besides selected gypsum products and as such allocation based on the mass of selected gypsum products was necessary. As a result, plant specific generic formulations for 1 MSF (92.9 m²) of the QuietRock® gypsum panels and gypsum core boards of interest were used to model and calculate the required intermediate products and formulation materials. LCI modeling did consider the plant specific fabrication yields. Similarly, plant specific generic formulations for 1 MSF (92.9 m²) of gypsum paper and mass was used as the basis for allocating flows across products and co-products of gypsum paper manufacturing.

5.4 CUT OFF RULES

The cut-off criteria as per NSF PCR, Section 7.1.6 [6] and ISO 21930, 7.1.8 [6], were followed for this EPD. Per ISO 21930, 7.1.8 [6], all input/output data required were collected and included in the LCI modelling. No substances with hazardous and toxic properties that pose a concern for human health and/or the environment were identified in the framework of this EPD. Any plant specific data gaps for the reference year 2017 e.g. input hydraulic fluids, lubricants, oils, or packaging materials were filled in with plant generic data from previous years or industry average data. PABCO® provided Safety Data Sheet (SDSs) confidentially per each chemical class e.g. sizing agents, retention chemicals, etc. Any data gaps in the SDS

are filled in with two generic LCI datasets, as appropriate (conservative assumptions): *Chemical, organic {GLO}| production | Cut-off, U; Chemical, inorganic {GLO}| production | Cut-off, U.*

Per NSF PCR, Section 7.1.6 [6], the Production Stage *excludes* the following processes:

- Capital goods and infrastructure;
- Human activity and personnel related activity (travel, furniture, office operations and supplies);
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

6 LIFE CYCLE ASSESSMENT

6.1 RESULTS OF THE LIFE CYCLE ASSESSMENT

This section summarizes the product stage life cycle impact assessment (LCIA) results including resource use and waste generated metrics based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated based on 92.9 m² (1 MSF) for each QuietRock® panel product of interest (Tables 4 to 9). *It is noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks* [3], [4].

Per NSF PCR, Section 7.3 [6], the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD. Per NSF PCR, Section 7.2.10, 7.2.13, 7.2.14 [6], the following mandatory resource use, waste categories and output flows are reported as described in Tables 4 to 9.

Table 4 Product Stage (A1-A3), EPD Results – 92.9 m² (1 MSF) of EZ-SNAP (Type X, 15.9 mm)

Impact category and inventory indicators	Unit	A1, Extraction and upstream production	A2, Transport to factory	A3, Manufacturing	Total
Global warming potential, GWP 100 ¹⁾ , AR5	kg CO ₂ eq	276.8	31.8	66.4	375
Ozone depletion potential, ODP ¹⁾	kg CFC-11 eq	3.3E-05	1.2E-09	6.1E-06	3.9E-05
Smog formation potential, SFP ¹⁾	kg O ₃ eq	12.04	17.43	2.69	32.2
Acidification potential, AP ¹⁾	kg SO ₂ eq	0.752	0.54	0.21	1.5
Eutrophication potential, EP ¹⁾	kg N eq	0.691	0.033	0.31	1.0
ADP LHV, CML ²⁾	MJ LHV	3,897.1	413.9	1,196.5	5,508
Renewable primary resources used as an energy carrier (fuel), RPR _E ³⁾	MJ LHV	350.7	0.0	171	522
Renewable primary resources with energy content used as material, RPR _M ³⁾	MJ LHV	0.0	0	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E ³⁾	MJ LHV	4,067	418	1,325	5,809
Non-renewable primary resources with energy content used as material, NRPR _M ³⁾	MJ LHV	0	0	0	0
Secondary materials, SM ³⁾	kg	70	0	0	70
Renewable secondary fuels, RSF ³⁾	MJ LHV	0	0	0	0
Non-renewable secondary fuels, NRSF ³⁾	MJ LHV	0	0	0	0
Recovered energy, RE ³⁾	MJ LHV	0	0	0	0
Consumption of freshwater, FW ³⁾	m ³	1	0	0	1.3
Hazardous waste disposed, HWD ³⁾	kg	0.007	0	0	0.01
Non-hazardous waste disposed, NHWD ³⁾	kg	5	0	0	5
High-level radioactive waste, conditioned, to final repository, HLRW ³⁾	m ³	9.1E-08	0.0E+00	5.7E-08	1.5E-07
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW ³⁾	m ³	1.2E-06	0.0E+00	8.4E-07	2.1E-06
Components for re-use, CRU ³⁾	kg	0	0	0	0
Materials for recycling, MR ³⁾	kg	1	0	24	25.9
Materials for energy recovery, MER ³⁾	kg	0	0	0	0
Recovered energy exported from the product system, EE ³⁾	MJ LHV	0	0	0	0

Table 5 Product Stage (A1-A3), EPD Results – 92.9 m² (1 MSF) of EZ-SNAP MR (Type X, 15.9 mm)

Impact category and inventory indicators	Unit	A1, Extraction and upstream production	A2, Transport to factory	A3, Manufacturing	Total
Global warming potential, GWP 100 ¹⁾ , AR5	kg CO ₂ eq	276.8	31.9	55.7	364
Ozone depletion potential, ODP ¹⁾	kg CFC-11 eq	3.3E-05	1.2E-09	5.4E-06	3.9E-05
Smog formation potential, SFP ¹⁾	kg O ₃ eq	12.04	17.44	2.32	31.8
Acidification potential, AP ¹⁾	kg SO ₂ eq	0.752	0.54	0.18	1.47
Eutrophication potential, EP ¹⁾	kg N eq	0.691	0.033	0.25	0.97
ADP LHV, CML ²⁾	MJ LHV	3,897	414.3	1,069	5,381
Renewable primary resources used as an energy carrier (fuel), RPR _E ³⁾	MJ LHV	350.7	0.0	145	496
Renewable primary resources with energy content used as material, RPR _M ³⁾	MJ LHV	0	0	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E ³⁾	MJ LHV	4,067	418	1,177	5,662
Non-renewable primary resources with energy content used as material, NRPR _M ³⁾	MJ LHV	0	0	0	0
Secondary materials, SM ³⁾	kg	70	0	0	70
Renewable secondary fuels, RSF ³⁾	MJ LHV	0	0	0	0
Non-renewable secondary fuels, NRSF ³⁾	MJ LHV	0	0	0	0
Recovered energy, RE ³⁾	MJ LHV	0	0	0	0
Consumption of freshwater, FW ³⁾	m ³	1	0	0	1.3
Hazardous waste disposed, HWD ³⁾	kg	0.007	0	0	0.01
Non-hazardous waste disposed, NHWD ³⁾	kg	5	0	0	5
High-level radioactive waste, conditioned, to final repository, HLRW ³⁾	m ³	9.1E-08	0.0E+00	4.6E-08	1.4E-07
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW ³⁾	m ³	1.2E-06	0.0E+00	7.3E-07	2.0E-06
Components for re-use, CRU ³⁾	kg	0	0	0	0
Materials for recycling, MR ³⁾	kg	1	0	24	25.9
Materials for energy recovery, MER ³⁾	kg	0	0	0	0
Recovered energy exported from the product system, EE ³⁾	MJ LHV	0	0	0	0

Table 6 Product Stage (A1-A3), EPD Results – 92.9 m² (1 MSF) of QuietRock® 500/510 (Regular, 12.7 mm)

Impact category and inventory indicators	Unit	A1, Extraction and upstream production	A2, Transport to factory	A3, Manufacturing	Total
Global warming potential, GWP 100 ¹⁾ , AR5	kg CO ₂ eq	308.9	86.1	56.1	451
Ozone depletion potential, ODP ¹⁾	kg CFC-11 eq	3.6E-05	3.6E-09	5.3E-06	4.1E-05
Smog formation potential, SFP ¹⁾	kg O ₃ eq	12.98	29.22	2.30	44.5
Acidification potential, AP ¹⁾	kg SO ₂ eq	0.764	1.13	0.18	2.07
Eutrophication potential, EP ¹⁾	kg N eq	0.882	0.068	0.25	1.20
ADP LHV, CML ²⁾	MJ LHV	4,299	1,224	1,061	6,584
Renewable primary resources used as an energy carrier (fuel), RPR _E ³⁾	MJ LHV	390.9	0.0	134	525
Renewable primary resources with energy content used as material, RPR _M ³⁾	MJ LHV	0	0	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E ³⁾	MJ LHV	4,533	1,238	1,169	6,940
Non-renewable primary resources with energy content used as material, NRPR _M ³⁾	MJ LHV	0	0	0	0
Secondary materials, SM ³⁾	kg	96	0	0	96
Renewable secondary fuels, RSF ³⁾	MJ LHV	0	0	0	0
Non-renewable secondary fuels, NRSF ³⁾	MJ LHV	0	0	0	0
Recovered energy, RE ³⁾	MJ LHV	0	0	0	0
Consumption of freshwater, FW ³⁾	m ³	2	0	0	1.7
Hazardous waste disposed, HWD ³⁾	kg	0.011	0	0	0.01
Non-hazardous waste disposed, NHWD ³⁾	kg	15	0	0	15
High-level radioactive waste, conditioned, to final repository, HLRW ³⁾	m ³	1.3E-07	0.0E+00	4.7E-08	1.8E-07
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW ³⁾	m ³	1.5E-06	0.0E+00	7.2E-07	2.2E-06
Components for re-use, CRU ³⁾	kg	0	0	0	0
Materials for recycling, MR ³⁾	kg	1	0	20	20.5
Materials for energy recovery, MER ³⁾	kg	0	0	0	0
Recovered energy exported from the product system, EE ³⁾	MJ LHV	0	0	0	0

Table 7 Product Stage (A1-A3), EPD Results – 92.9 m² (1 MSF) of QuietRock® 530 (Type X, 15.9 mm)

Impact category and inventory indicators	Unit	A1, Extraction and upstream production	A2, Transport to factory	A3, Manufacturing	Total
Global warming potential, GWP 100 ¹⁾ , AR5	kg CO ₂ eq	793.0	116.5	103.5	1,013
Ozone depletion potential, ODP ¹⁾	kg CFC-11 eq	3.5E-05	4.9E-09	1.0E-05	4.5E-05
Smog formation potential, SFP ¹⁾	kg O ₃ eq	56.95	39.56	4.24	100.8
Acidification potential, AP ¹⁾	kg SO ₂ eq	3.130	1.53	0.33	4.98
Eutrophication potential, EP ¹⁾	kg N eq	0.986	0.092	0.47	1.55
ADP LHV, CML ²⁾	MJ LHV	10,641	1,658	1,897	14,197
Renewable primary resources used as an energy carrier (fuel), RPR _E ³⁾	MJ LHV	1,315	0.0	215	1,530
Renewable primary resources with energy content used as material, RPR _M ³⁾	MJ LHV	0	0	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E ³⁾	MJ LHV	11,196	1,677	2,100	14,973
Non-renewable primary resources with energy content used as material, NRPR _M ³⁾	MJ LHV	0	0	0	0
Secondary materials, SM ³⁾	kg	91	0	0	91
Renewable secondary fuels, RSF ³⁾	MJ LHV	0	0	0	0
Non-renewable secondary fuels, NRSF ³⁾	MJ LHV	0	0	0	0
Recovered energy, RE ³⁾	MJ LHV	0	0	0	0
Consumption of freshwater, FW ³⁾	m ³	13	0	0	13.2
Hazardous waste disposed, HWD ³⁾	kg	2.1	0	0	2.09
Non-hazardous waste disposed, NHWD ³⁾	kg	12	0	0	12
High-level radioactive waste, conditioned, to final repository, HLRW ³⁾	m ³	1.2E-07	0.0E+00	8.8E-08	2.1E-07
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW ³⁾	m ³	1.4E-06	0.0E+00	1.4E-06	2.7E-06
Components for re-use, CRU ³⁾	kg	0	0	0	0
Materials for recycling, MR ³⁾	kg	1	0	26	27.4
Materials for energy recovery, MER ³⁾	kg	0	0	0	0
Recovered energy exported from the product system, EE ³⁾	MJ LHV	0	0	0	0

Table 4 Product Stage (A1-A3), EPD Results – 92.9 m² (1 MSF) of QuietRock® 530 RF (Type X, 15.9 mm)

Impact category and inventory indicators	Unit	A1, Extraction and upstream production	A2, Transport to factory	A3, Manufacturing	Total
Global warming potential, GWP 100 ¹⁾ , AR5	kg CO ₂ eq	793.0	116.5	260.8	1,170
Ozone depletion potential, ODP ¹⁾	kg CFC-11 eq	3.5E-05	4.9E-09	2.1E-05	5.6E-05
Smog formation potential, SFP ¹⁾	kg O ₃ eq	56.95	39.56	9.80	106.3
Acidification potential, AP ¹⁾	kg SO ₂ eq	3.130	1.53	0.70	5.36
Eutrophication potential, EP ¹⁾	kg N eq	0.986	0.092	1.44	2.51
ADP LHV, CML ²⁾	MJ LHV	10,641	1,658	3,801	16,101
Renewable primary resources used as an energy carrier (fuel), RPR _E ³⁾	MJ LHV	1,315	0.0	590	1,905
Renewable primary resources with energy content used as material, RPR _M ³⁾	MJ LHV	0	0	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E ³⁾	MJ LHV	11,196	1,677	4,302	17,176
Non-renewable primary resources with energy content used as material, NRPR _M ³⁾	MJ LHV	0	0	0	0
Secondary materials, SM ³⁾	kg	91	0	0	91
Renewable secondary fuels, RSF ³⁾	MJ LHV	0	0	0	0
Non-renewable secondary fuels, NRSF ³⁾	MJ LHV	0	0	0	0
Recovered energy, RE ³⁾	MJ LHV	0	0	0	0
Consumption of freshwater, FW ³⁾	m ³	13	0	0	13.2
Hazardous waste disposed, HWD ³⁾	kg	2.1	0	0	2.09
Non-hazardous waste disposed, NHWD ³⁾	kg	12	0	0	12
High-level radioactive waste, conditioned, to final repository, HLRW ³⁾	m ³	1.2E-07	0.0E+00	2.4E-07	3.6E-07
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW ³⁾	m ³	1.4E-06	0.0E+00	2.9E-06	4.3E-06
Components for re-use, CRU ³⁾	kg	0	0	0	0
Materials for recycling, MR ³⁾	kg	1	0	26	27.4
Materials for energy recovery, MER ³⁾	kg	0	0	0	0
Recovered energy exported from the product system, EE ³⁾	MJ LHV	0	0	0	0

Table 5 Product Stage (A1-A3), EPD Results – 92.9 m² (1 MSF) of QuietRock® 545 (Type X, 34.9 mm)

Impact category and inventory indicators	Unit	A1, Extraction and upstream production	A2, Transport to factory	A3, Manufacturing	Total
Global warming potential, GWP 100 ¹⁾ , AR5	kg CO ₂ eq	1621.5	295.9	205.9	2,123
Ozone depletion potential, ODP ¹⁾	kg CFC-11 eq	7.2E-05	1.2E-08	1.9E-05	9.2E-05
Smog formation potential, SFP ¹⁾	kg O ₃ eq	90.70	127.18	8.19	226.1
Acidification potential, AP ¹⁾	kg SO ₂ eq	5.100	4.63	0.61	10.34
Eutrophication potential, EP ¹⁾	kg N eq	1.979	0.266	1.01	3.25
ADP LHV, CML ²⁾	MJ LHV	20,973	4,049	3,507	28,529
Renewable primary resources used as an energy carrier (fuel), RPR _E ³⁾	MJ LHV	2,075	0.0	414	2,489
Renewable primary resources with energy content used as material, RPR _M ³⁾	MJ LHV	0	0	0	0
Non-renewable primary resources used as an energy carrier (fuel), NRPR _E ³⁾	MJ LHV	22,234	4,092	3,911	30,237
Non-renewable primary resources with energy content used as material, NRPR _M ³⁾	MJ LHV	0	0	0	0
Secondary materials, SM ³⁾	kg	192	0	0	192
Renewable secondary fuels, RSF ³⁾	MJ LHV	0	0	0	0
Non-renewable secondary fuels, NRSF ³⁾	MJ LHV	0	0	0	0
Recovered energy, RE ³⁾	MJ LHV	0	0	0	0
Consumption of freshwater, FW ³⁾	m ³	15	0	0	15.0
Hazardous waste disposed, HWD ³⁾	kg	2.1	0	0	2.10
Non-hazardous waste disposed, NHWD ³⁾	kg	193	0	0	193
High-level radioactive waste, conditioned, to final repository, HLRW ³⁾	m ³	2.6E-07	0.0E+00	1.8E-07	4.4E-07
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW ³⁾	m ³	1.4E-06	1.4E-09	2.9E-06	4.3E-06
Components for re-use, CRU ³⁾	kg	0	0	0	0
Materials for recycling, MR ³⁾	kg	2	0	54	56.5
Materials for energy recovery, MER ³⁾	kg	0	0	0	0
Recovered energy exported from the product system, EE ³⁾	MJ LHV	0	0	0	0

Notes to Tables 4 to 9:

¹⁾ Calculated as per U.S EPA TRACI 2.1, v1.05, SimaPro v 9 [10]. GWP₁₀₀, excludes biogenic CO₂ removals and emissions associated with biobased products such as starch and dextrose (see Table 10 for details); 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5), TRACI 2.1, with AR5, v1.05 [10].

²⁾ Calculated as per CML-IA Baseline V3.05, SimaPro v 9. ADP LHV, CML is required in LEED V 4 and V4.1 MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations [13].

³⁾ Calculated as per ACLCA ISO 21930 Guidance [11], respective sections 6.2 to 10.8.

Per NSF PCR, 7.2.7 [5], for paper faced gypsum panel products, recycled raw materials used to produce the paper are not counted as biogenic carbon whereas starch and dextrose are counted. Table 10 shows the cradle-to-gate biogenic CO₂ removals associated with bio-based products used in the gypsum board system.

Table 10 Production Stage (A1-A3), Biogenic CO₂ removals – 92.9 m² (1 MSF) of QuietRock® panels

Inputs	Chemical formula	C-Content (in %)	Biogenic CO ₂ removals (in kg CO ₂ / MSF)					
			EZ-SNAP	EZ-SNAP MR	QuietRock® 500/510	QuietRock® 530	QuietRock® 530 RF	QuietRock® 545
Starch	(C ₆ H ₁₀ O ₅) _n	44%	-24.7 ¹⁾	-24.7	-26.3	-26.3	-26.3	-52.7
Dextrose	C ₆ H ₁₂ O ₆	40%	-7.7	-7.7	-8.8	-8.8	-8.8	-17.5

Notes:

¹⁾ 44 and 12 is the molar mass of CO₂ and C (in g/mol), respectively.

²⁾ It includes the amount of dextrose that is applied directly to the board (not part of BMA, Table 2), and the amount of dextrose mixed with landplaster to produce BMA (also known as heat resistant accelerator, HRA). The weighted average amount of dextrose in BMA resulted to 15%.

6.2 INTERPRETATION

The cradle-to-gate manufacturing results per MSF (92.9 m²) vary across the QuietRock® product line. What is evident is that there is a strong relationship between the mass of a product and the LCIA results. For example, the two EZ-SNAP products and the QR500/510 represent lighter products in the QuietRock® family and they in general demonstrate lower potential impacts across the product line – varying between 360 and 450 kg CO₂eq./MSF and embodying 6.2 to 7.5 GJ of primary energy (LHV). Conversely, the higher mass products (QuietRock® 530, 530RF and 545) demonstrate higher impacts – embodying between 17 to 32 GJ of primary energy and emitting between 1,000 to 2,000 kg CO₂e/MSF. A consistent finding across the complete QuietRock® product line is that more than 90% of the total primary energy is derived from non-renewable primary energy resources.

Across the QuietRock® product line, it is evident that Module A1 accounts for most of the calculated life cycle impact assessment burdens – typically accounting for between 40% up to over 80% of the potential impacts across LCIA indicators and energy inputs. For the lighter products (EZ-SNAP, EZ-SNAP MR and QuietRock® 500/510) the A1 contribution is primarily a function of the core gypsum board used in their production (regular or Type X); however, for the heavier products incorporating a metal layer (QuietRock® 530 and QuietRock® 530RF) the metal layer itself can account for more than 50% of the A1 indicator results. Similarly, for QuietRock® 545, the combination of the metal layer in the core as well as MgO board stock layer can account for more than 50% of the reported A1 indicator results.

Transportation (Module A2) except for smog formation potential (SFP) and acidification potential (AP), generally accounts for less than 10% of the total potential impacts.

QuietRock® panel manufacturing (A3) across the product line accounts for about 20% of the greenhouse gases emitted (GWP₁₀₀) and non-renewable energy use. Across the other measures, it can vary between less than 10% to as much as 35%. Electricity and adhesive use are the primary sources of the burdens reported in A3.

7 ADDITIONAL ENVIRONMENTAL INFORMATION

- *Health Protection Manufacture*
The OSHA standards are applicable and followed.
 - U.S. Department of Labor, Occupational Safety & Health Administration (OSHA), 29 CFR, PART 1910 Occupational Safety and Health Standards.
https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910, accessed 08-2020.No additional health protection measures extending beyond mandatory occupational safety measures for commercial operations are required.
- *Environmental Protection Manufacture and Equipment*
PABCO® manufacturing facilities comply with US regional environmental protection requirements, monitor and report the emissions to air during the manufacturing process as per the following:
 - EPCRA Section 313 Toxic Release Inventory Reporting (U.S)
https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910, accessed 08-2020.*Pollution abatement equipment* typically used at PABCO® Gypsum manufacturing facilities consist of high and low temperature baghouses, bin vent filter and low NOx burners.

8 DECLARATION TYPE AND PRODUCT AVERAGE DECLARATION

This type of EPD is defined as:

- A “Cradle-to-gate” EPD for the QuietRock® product line covering the *Production stage* (information modules A1 to A3) and is intended for use in *Business-to-Business* communication.
- This EPD for various products making up the QuietRock® product line (*NAICS Code 327420*) falls under the description: *A company and product specific EPD.*

9 DECLARATION COMPARABILITY LIMITATION STATEMENT

The following ISO 21930 statements indicate the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on the NSF PCR for Gypsum Panel Products [6]:

- *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.*

10 EPD EXPLANATORY MATERIAL

For any explanatory material, regarding the PABCO® Gypsum EPD for QuietRock® gypsum panels based on this Project Report, please contact the program operator.

ASTM International
Environmental Product Declarations
100 Barr Harbor Drive,
West Conshohocken,
PA 19428-2959, <http://www.astm.org>

11 REFERENCES

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7. ISO 14025:2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
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[https://www.astm.org/CERTIFICATION/DOCS/162.ASTM General Program Instructions 6.0 110414.pdf](https://www.astm.org/CERTIFICATION/DOCS/162.ASTM%20General%20Program%20Instructions%206.0%20110414.pdf), accessed 08-2020.