

**Declaration Owner**

Cardinal Acoustics Inc.

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Product:

Acoustic Panels

5/8", 1", 1"+1" acoustic backing, and 1.5" thickness products

Functional Unit

The functional unit is 0.093 m² (1 ft²) of installed panel with a reference service life (RSL) of 30 years

EPD Number and Period of Validity

SCS-EPD-10622

EPD Valid March 26, 2026 through March 25, 2031

Product Category Rule

UL Product Category Rule (PCR) Guidance for Building-Related Products and Service, Part A: Life Cycle Assessment Calculation Rule and Report Requirements. Version 4.0. March 2022.

UL Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part B: Non-Metal Ceiling and Interior Wall Panel System EPD Requirements. Version 2.0. April 13, 2021.

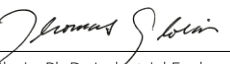
Program Operator

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Declaration owner:	Cardinal Acoustics
Address:	2941 Donnylane Blvd. Columbus, OH 43235
Declaration Number:	SCS-EPD-10622
Date of Issue:	March 26, 2026
Declaration Validity Period:	EPD Valid March 26, 2026 through March 25, 2031
Program Operator:	SCS Global Services, 2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
General Program Instructions:	SCS Type III Environmental Declaration Program: Program Operator Manual. V12.0 December 2023.
Product(s):	Acoustic Panels
Declared Unit or Functional Unit:	0.093 m2 (1 ft2) of installed panel with a reference service life (RSL) of 30 years
Product's Intended Application and Use:	For installation on walls and ceilings
Product RSL (if applicable):	30 years
Markets of Applicability:	North America
EPD Type:	Product specific
EPD Scope:	Cradle to grave
Year(s) of Reported Manufacturer Primary Data:	2025
LCA Software & Version Number:	OpenLCA 2.5.0
LCI Database(s) & Version Number:	Ecoinvent 3.11
LCIA Methodology & Version Number:	TRACI 2.2
Reference PCR:	UL Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part B: Non-Metal Ceiling and Interior Wall Panel System EPD Requirements. Version 2.0. April 13, 2021.
Sub-category PCR review:	Lindita Bushi, Sustainable Materials Institute, Tom Gloria, Industrial Ecology Consultants; Olivia Palmer, Simpson Gumpertz & Heger
LCA Practitioner:	Millicent Gabriel, SCS Global Services
Independent critical review of the LCA and data, according to ISO 14044 and the PCR:	☐ internal ☒ external
LCA Reviewer:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants
Independent verification of the declaration and data, according to ISO 14025 and the PCR:	☐ internal ☒ external
EPD Verifier:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	1. Cardinal Acoustics..... 2 2. Product 2 3. LCA: Calculation Rules 4 4. LCA: Scenarios and Additional Technical Information 9 5. LCA: Results..... 13 6. LCA: Interpretation 19 7. Additional Environmental Information 19 8. References..... 21

Disclaimers: This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.

Scope of Results Reported: The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.

Accuracy of Results: Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in accuracy.

Comparability: The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works. The owner of the declaration shall be liable for the underlying information and evidence; SCS shall not be liable with respect to manufacturer information, life cycle assessment data, and evidence supplied or made available to SCS.

1. Cardinal Acoustics

Cardinal Acoustics, Inc. is a family owned and operated U.S.-based manufacturer of architectural acoustical panel systems serving commercial, educational, and civic building projects throughout North America. For over 40 years the company has specialized in the custom processing and finishing of wood-wool cementitious panels and related acoustical products. Products are manufactured to project-specific dimensions and configurations, with their catalog including wall panels, ceiling panels, and integrated acoustical systems. Cardinal Acoustics operates to produce made-to-order solutions rather than standardized mass produced goods. Cardinal Acoustics carries out its manufacturing processes at its fabrication plant in Springfield, Ohio that utilizes only the finest materials to ensure consistent quality and performance, supplying products across the United States and Canada through a combination of distributor channels and direct-to-project sales.

2. Interior Panels

2.1 PRODUCT DESCRIPTION

Cardinal Acoustics products consist of interior architectural acoustical panels fabricated from wood-wool cementitious boards. Panels are custom processed to project-specific dimensions and configurations and are used for sound absorption and interior finish applications in commercial, educational, and civic buildings. Fabrication processes include CNC machining, sawing, edge detailing, assembly, and finishing. Panels are designed for installation on walls or ceilings using standard mechanical attachment methods or suspended ceiling grid systems. Products are intended for interior, non-structural use and contribute to acoustical performance, durability, and long service life within conditioned building environments. The resulting product is durable, attractive, and easily decorated. These products are Class A/Class I rated with a flame spread and smoke spread of 0, in accordance with ASTM E-84. Cardinal Acoustics panels efficiently absorb up to 100% of sound and stand up to daily abuse in high traffic, high use areas – perfect for anywhere acoustic absorption, toughness and flexible design is needed.



Figure 1. A suspended network of Cardinal Acoustics' panels.

2.2 PRODUCT SPECIFICATION

The Cardinal Acoustics products covered in this study include a variety of thicknesses from 5/8", 1", 1.5" and a variation that combines Cardinal's 1" panel with an additional 1" acoustic backing (1"+1"). These products belong to the Construction Specification Institute (CSI) codes 09 84 33 for sound-absorbing wall units and 09 84 36 for sound-absorbing ceiling units and the following United Nations Standard Products and Services Code (UNSPSC) categories: 30161500 (Wall Panels) and 30161602 (Ceiling Panels).

2.3 FLOW DIAGRAM

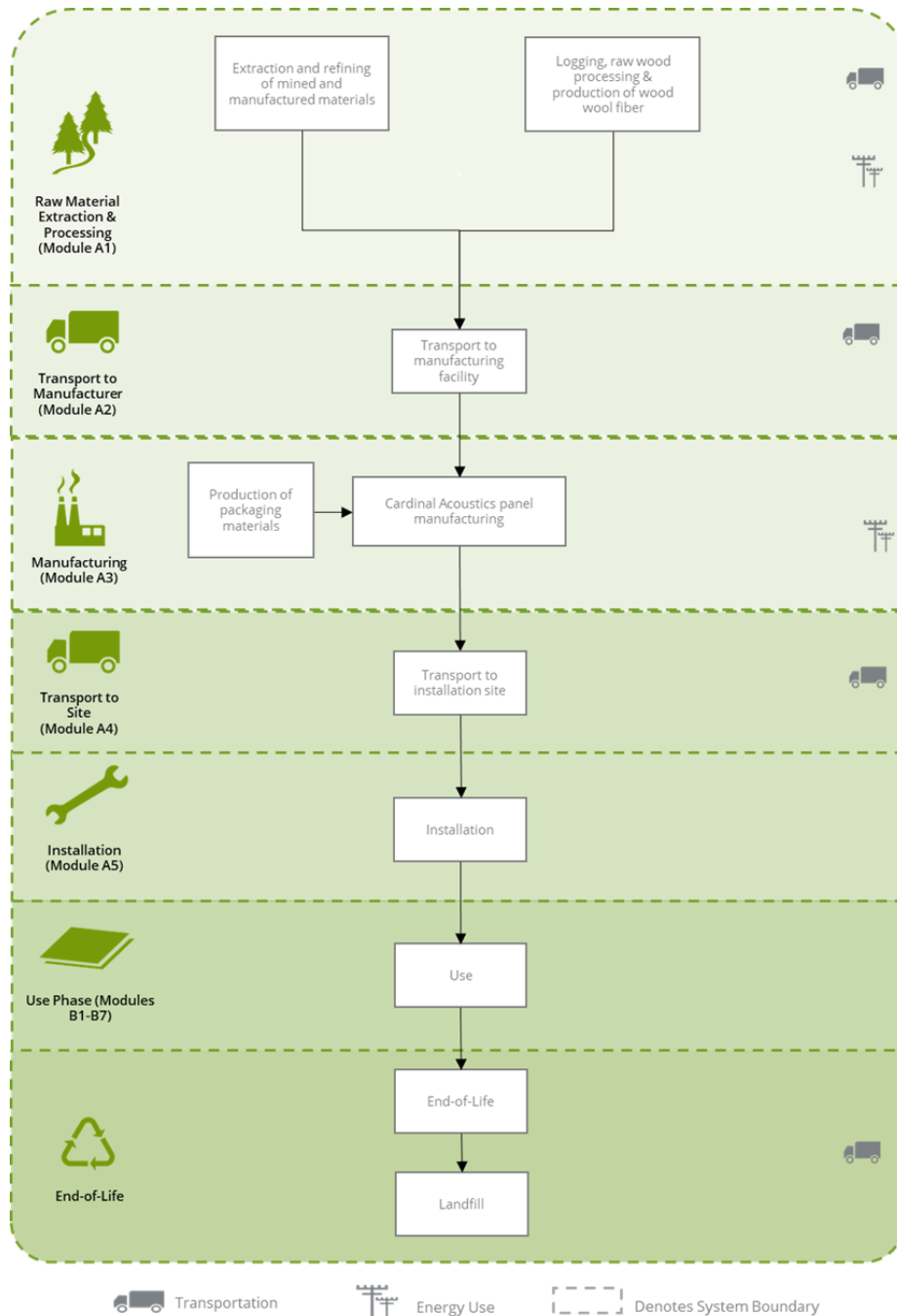


Figure 2. Flow diagram and system boundaries for the life cycle of the Cardinal Acoustics panel products in this study.

2.4 PRODUCT AVERAGE

All products were assessed on the basis of a representative product that is 0.093 m² (1 ft²) in area. Results were calculated based on manufacturer provided data representing a mass-based average of product materials, packaging materials, and total annual production.

2.5 APPLICATION

The Cardinal Acoustics products in this study are designed for installation on walls or ceilings using standard mechanical attachment methods or suspended ceiling grid systems. Note that no furring or mounting components are in scope for this study.

2.6 TECHNICAL REQUIREMENTS

All Cardinal Acoustics panels in this study meet the requirements of ASTM E1264 Type XIV, pattern F, Class A as tested in accordance to ASTM E84. Further technical specifications for the acoustic panels are summarized in Table 1 below. Note that all sound absorption tests were conducted with a simple mounting setup of each panel laid directly against a wall surface and secured with screws. The acoustic test results for other mounting setups can be found on the company's website at www.cardinalacoustics.com.

Table 1. Technical specifications for Cardinal Acoustics panels in scope for this study.

Technical Data	Unit	5/8"	1"	1.5"	1"+1"
Fire Rating: Surface burning characteristics of building materials (ASTM E84, ASTM E1264)	Flame spread/smoke developed	Class A	Class A	Class A	Class A
Light Reflectance: Luminous reflectance for painted acoustical wall and ceiling panel (ASTM E1477)	%	89.94	89.94	89.94	89.94
Sound Absorption Average (SAA): The average of the sound absorption coefficients (α) of a material for the twelve one-third octave bands from 200 through 2500 Hz (ASTM C423, ASTM E795)	N/A	0.44	0.61	0.68	0.92
Noise Reduction Coefficient (NRC): the average of sound absorption coefficients (α) at 250, 500, 1000, and 2000 Hz, expressed to the nearest multiple of 0.05 (ASTM C423-17, ASTM E795)	N/A	0.45	0.60	0.70	0.90

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The panels are delivered as panels and shape is specific to the client's application/needs.

3. LCA: Calculation Rules

3.1 FUNCTIONAL UNIT

According to ISO 14044, the functional unit is "the quantified performance of a product system, for use as a reference unit." The functional unit for the Cardinal Acoustics panels in this study is defined as 0.093 m² of installed panel with a reference service life (RSL) of 30 years.

Table 2. Functional unit properties for the Cardinal Acoustics panels in scope for this study.

Property	Unit	5/8"	1"	1.5"	1"+1"
Functional Unit	m ²	0.093	0.093	0.093	0.093
Thickness	inch	0.625	1.00	1.50	2.00
Thickness	cm	1.59	2.54	3.81	5.08
Surface Weight per Functional Unit	kg/m ²	7.51	10.7	16.6	16.9
Density per Functional Unit	kg/m ³	4,725	4,205	4,346	3,320

2.6 SYSTEM BOUNDARY

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The life cycle phases included in the product system boundary are shown below.

Table 3. System boundary for the Cardinal Acoustics panels in this study.

Product			Construction		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

X = Module Included | MND = Module Not Declared

3.3 REFERENCE SERVICE LIFE AND ESTIMATED BUILDING SERVICE LIFE

The panels in this study have a Reference Service Life (RSL) of 30 years and Estimated Building Service Life (ESL) of 75 years according to the Product Category Rule (PCR).

3.4 ALLOCATION

This study follows the allocation guidelines of ISO 14044 and sought to minimize the use of allocation wherever possible. In general, manufacturing facilities may produce multiple products, and in such cases it is necessary to divide the environmental impacts between the different products. Resource and electricity use for the manufacturing facility was allocated using a mass-based approach based on the total production of panels at the Springfield, Ohio facility. Note that no green power is used in this EPD project and no CO₂ certificates are used in this EPD project.

The secondary databases used for the product system apply allocation based primarily on physical relationships (e.g., volume, energy content, or mass-based relationships). Impacts from the transportation, including product distribution to the installation site, were allocated based on the mass of material and distance transported.

3.5 CUT-OFF RULES

No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD. No burdens are allocated across the system boundary with secondary material, secondary fuel, or recovered energy flows arising from waste.

3.6 DATA SOURCES

To the extent available, primary data are used for foreground processes (e.g., product manufacturing), while background processes are modeled using secondary data with a bias towards the most recent and representative data. Unit processes were developed with the OpenLCA v2.5.0 LCI model, drawing data from multiple sources. Primary data were provided by Cardinal Acoustics for the manufacturing facility in Springfield, Ohio. The principal source of secondary LCI data is the Ecoinvent database. The datasets used in the LCA model to represent the manufacture of the panels in this study are shown below in Table 4.

Table 4. LCI datasets used to model the Cardinal Acoustics panels in this study.

Flow	Dataset	Data Source	Publication Date
Product without Acoustic Backing			
Popular Wood Wool Fiber	wood wool production wood wool Cutoff, U - RoW	Ecoinvent 3.11	2024
Aluminum Oxide	aluminium oxide production aluminium oxide, metallurgical Cutoff, U - CN	Ecoinvent 3.11	2024
Magnesium Oxide	magnesium oxide production magnesium oxide Cutoff, U - RoW	Ecoinvent 3.11	2024
Magnesium Sulphate	magnesium sulfate production magnesium sulfate Cutoff, U - RoW	Ecoinvent 3.11	2024
Silicon Dioxide	activated silica production activated silica Cutoff, U - GLO	Ecoinvent 3.11	2024
Water	market for tap water tap water Cutoff, U - RoW	Ecoinvent 3.11	2024
Polyester (Acoustic backing)	textile production, nonwoven polyester, needle-punched textile, nonwoven polyester Cutoff, U - RoW	Ecoinvent 3.11	2024
Packaging			
Cardboard	corrugated board box production corrugated board box Cutoff, U - US	Ecoinvent 3.11	2024
Straps	polyethylene production, high density, granulate polyethylene, high density, granulate Cutoff, U - RoW	Ecoinvent 3.11	2024
	extrusion of plastic sheets and thermoforming, inline extrusion of plastic sheets and thermoforming, inline Cutoff, U - RoW	Ecoinvent 3.11	2024
Pallet	EUR-flat pallet production EUR-flat pallet Cutoff, U - RoW	Ecoinvent 3.11	2024
Manufacturing Inputs			
Electricity	market for electricity, medium voltage electricity, medium voltage (modified for regional electricity grid using eGRID data)	Ecoinvent 3.11	2024
Natural Gas	heat and power co-generation, natural gas, combined cycle power plant, 400MW electrical heat, district or industrial, natural gas Cutoff, U - US-RFC	Ecoinvent 3.11	2024
Transport			
Truck Transport	transport, freight, lorry, 16-32 metric ton, diesel, EURO 4 transport, freight, lorry, 16-32 metric ton, diesel, EURO 4 Cutoff, U - RoW	Ecoinvent 3.11	2024
Waste Outputs			
Landfill	process-specific burdens, inert material landfill process-specific burdens, inert material landfill Cutoff, U - RoW	Ecoinvent 3.11	2024

3.7. DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 5. *Data quality assessment.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The manufacturer provided primary data on product manufacturing for the Springfield, Ohio facility on an annual production scale for 2025. Representative datasets (secondary data) for upstream and background processes are generally less than 5 years old.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for products manufactured is modeled using representative data modelled for the specific electricity grids represented in this study. Surrogate data used in the assessment are representative of global operations and are considered sufficiently similar to actual processes.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative component datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represents typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards the most recent dataset where available. Different portions of the product life cycle are equally considered.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of the data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the Springfield facility represents a 12-month average and is considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.11 data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment methodology includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.8 PERIOD UNDER REVIEW

The period of review is January 1st, 2025 through December 31st, 2025.

3.9 COMPARABILITY AND BENCHMARKING

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

3.10 ESTIMATES AND ASSUMPTIONS

The assessment relied on a number of assumptions related to material composition, processing, installation, use and end-of-life disposal. The major assumptions used in the assessment are described below.

- The Cardinal Acoustics manufacturing facility is located in Springfield, Ohio. Electricity and resource use at the facility is based on regional eGRID Ecoinvent data modified for the EPA subregion RFCW, in which Springfield is located.
- Electricity and resource use at the production facility were allocated to the acoustic panel products based on product mass utilizing production data for calendar year 2025 provided by the manufacturer.
- Disposal of product and packaging is modeled based for municipal solid waste generation and disposal in the United States, as specified in the PCR.
- For final disposal of manufacturing scrap, packaging material and the product at end-of-life, the EPA Waste Reduction Model (WARM) assumption of 20 miles (~32 km) was used to model distance traveled by diesel truck to either a landfill or material reclamation facility (for recycling). Datasets representing disposal are from Ecoinvent.
- Installation of the products is assumed to be manual, requiring no additional energy use.
- Product waste from installation is assumed to be 5%.
- Transport of packaged product from distribution centers to points of sale or installation is assumed to be 100 km by truck. All other distribution distances are primary data sourced from the manufacturer.
- The product is assumed to require no repair or refurbishment over its service life.
- The Estimated Service Life (ESL) of the building/construction works was assumed to be 75 years, per the PCR, to be consistent with ASHRAE 189.1 (2014, Section 9.5.1).
- According to the manufacturer, the product can be cleaned at any point during its lifetime using a soapy water solution, but it is not necessary to do so. Therefore cleaning was excluded from this life cycle assessment.
- The product requires no operational energy or operational water usage during its service life.
- For the product end-of-life, disposal of product is assumed to be in a landfill.

3.11 UNITS

All data and results are presented using SI units.

4. LCA: Scenarios and Additional Technical Information

4.1 MATERIAL COMPOSITION

Table 6 summarizes the components by weight and material type for each product line, including product scrap, as well as the packaging materials for each product. Also presented are the material components as a percent of total mass.

Table 6. Material component summary for the Cardinal Acoustics 5/8" Interior Panel per 0.093 m².

Raw Materials	Recycled Content (%)	Mass Final Product (kg)	Percent of Product (%)
Popular Wood Wool Fiber	0.00	0.386	55%
Aluminum Oxide	0.00	0.154	22%
Magnesium Oxide	0.00	7.03x10 ⁻²	10%
Magnesium Sulphate	0.00	4.08x10 ⁻²	5.8%
Silicon Dioxide	0.00	3.87x10 ⁻²	5.5%
Water	0.00	9.07x10 ⁻³	1.3%
Total:		0.699	100%
Biogenic Carbon Content in Product:		0.632 kg CO₂ eq	
Packaging		Mass (kg)	Packaging (%)
Pallet	0.00	2.72x10 ⁻²	43%
Strapping	0.00	2.42x10 ⁻²	38%
Cardboard	0.00	1.21x10 ⁻²	19%
Total:		6.35x10⁻²	100%
Biogenic Carbon Content in Packaging:		6.67x10⁻² kg CO₂ eq	

*May not sum to total due to rounding

Table 7. Material component summary for the Cardinal Acoustics 1" Interior Panel per 0.093 m².

Raw Materials	Recycled Content (%)	Mass Final Product (kg)	Percent of Product (%)
Popular Wood Wool Fiber	0.00	0.549	55%
Aluminum Oxide	0.00	1.36x10 ⁻²	22%
Magnesium Oxide	0.00	9.98x10 ⁻²	10%
Magnesium Sulphate	0.00	5.44x10 ⁻²	5.9%
Silicon Dioxide	0.00	5.90x10 ⁻²	5.5%
Water	0.00	0.218	1.4%
Total:		0.993	100%
Biogenic Carbon Content in Product:		0.900 kg CO₂ eq	
Packaging		Mass (kg)	Packaging (%)
Pallet	0.00	4.54x10 ⁻²	44%
Strapping	0.00	3.78x10 ⁻²	37%
Cardboard	0.00	1.89x10 ⁻²	19%
Total:		0.102	100%
Biogenic Carbon Content in Packaging:		0.109 kg CO₂ eq	

*May not sum to total due to rounding

Table 8. Material component summary for the Cardinal Acoustics 1.5" Interior Panel per 0.093 m².

Raw Materials	Recycled Content (%)	Mass Final Product (kg)	Percent of Product (%)
Popular Wood Wool Fiber	0.00	0.848	55%
Aluminum Oxide	0.00	2.27x10 ⁻²	22%
Magnesium Oxide	0.00	0.154	10%
Magnesium Sulphate	0.00	8.48x10 ⁻²	5.9%
Silicon Dioxide	0.00	9.07x10 ⁻²	5.5%
Water	0.00	0.339	1.5%
Total:		1.54	100%
Biogenic Carbon Content in Product:		1.39 kg CO₂ eq	
Packaging		Mass (kg)	Packaging (%)
Pallet	0.00	6.80x10 ⁻²	44%
Strapping	0.00	5.67x10 ⁻²	37%
Cardboard	0.00	2.84x10 ⁻²	19%
Total:		0.153	100%
Biogenic Carbon Content in Packaging:		0.163 kg CO₂ eq	

Table 9. Material component summary for the Cardinal Acoustics 1" plus 1" Acoustic Backing Complete Panel per 0.093 m².

Raw Materials	Recycled Content (%)	Mass Final Product (kg)	Percent of Product (%)
Popular Wood Wool Fiber	0.00	0.848	54%
Aluminum Oxide	0.00	2.27x10 ⁻²	22%
Magnesium Oxide	0.00	0.154	10%
Magnesium Sulphate	0.00	8.48x10 ⁻²	5.8%
Silicon Dioxide	0.00	9.07x10 ⁻²	5.4%
Water	0.00	0.339	1.4%
Total:		2.84x10 ⁻²	1.8%
Biogenic Carbon Content in Product:		1.39 kg CO₂ eq	100%
Packaging		Mass (kg)	Packaging (%)
Pallet	0.00	6.80x10 ⁻²	44%
Strapping	0.00	5.67x10 ⁻²	37%
Cardboard	0.00	2.84x10 ⁻²	19%
Total:		0.153	100%
Biogenic Carbon Content in Packaging:		0.163 kg CO₂ eq	

*May not sum to total due to rounding

4.2 MANUFACTURE

Cardinal Acoustics ceiling tiles and panels are manufactured in Springfield, Ohio. The manufacturer provided primary data for twelve months of data including production, resource use and electricity consumption, and waste generation at the facility. Electricity consumption is modeled using Ecoinvent datasets for the regional resource mix with the closest match to the facility. Note that no green power is used in this EPD.

4.3 PACKAGING

The thin nature of the product allows it to be shipped efficiently and with minimal packaging. The product is shipped with core strapping and cardboard edge protectors on wooden pallets.

4.4 TRANSPORTATION

Transportation for the LCA model is based on data provided by the manufacturer for transport from the component manufacturer (1st tier supplier) to the production facility in Springfield, Ohio. Transportation data for 2nd tier suppliers (material supplier to component manufacturer) are based on data embedded in the representative LCI datasets. Transport from manufacturer to installation or to a distribution center is modeled through primary data provided by Cardinal Acoustics and was calculated based on percentages of each product transported to major regions of the United States. Transport of the packaged product from distribution centers to points of sale is assumed to be 100 km by truck. All road transport is assumed to be by diesel truck.

Table 10. Distribution transportation summary for Cardinal Acoustics panels in this study, per 0.093 m² of panel.

Name	Unit	Cardinal Acoustics 5/8" Interior Panel	Cardinal Acoustics 1" Interior Panel	Cardinal Acoustics 1.5" Interior Panel	Cardinal Acoustics 1"+1" Interior Panel
Vehicle type	-	Truck	Truck	Truck	Truck
Fuel type	-	Diesel	Diesel	Diesel	Diesel
Lites of fuel	l/100km	18.7	18.7	18.7	18.7
Transport distance	kg*km	1237	1777	2746	2792
Capacity utilization	%	-	-	-	-
Gross density of products transported	kg/m ³	-	-	-	-
Capacity utilization volume factor	-	1	1	1	1
Gross mass of products transported including packaging	kg	0.762	1.10	1.69	1.72

4.5 INSTALLATION IN THE BUILDING

Installation of the panels is completed manually without the aid of machinery. Waste is generated from the disposal of the packaging material and installation scrap and is modeled as required in the Part A PCR. Table 11 summarizes the modeling parameters for the product installation phase.

Table 11. *Installation summary for Cardinal Acoustics panels in this study, per 0.093 m².*

Name	Unit	Value
Ancillary materials	kg	0.00
Net freshwater consumption specified by water source	m ³	0.00
Other resources	kg	0.00
Electricity consumption	kWh	0.00
Other energy carriers	MJ	0.00
Product loss per functional unit		
5/8" Interior Panel	kg	3.49x10 ⁻²
1" Interior Panel	kg	4.97x10 ⁻²
1.5" Interior Panel	kg	7.70x10 ⁻²
1"+1" Interior Panel	kg	7.84x10 ⁻²
Waste materials at the construction site before waste processing, generated by product installation		
5/8" Interior Panel	kg	3.49x10 ⁻²
1" Interior Panel	kg	4.97x10 ⁻²
1.5" Interior Panel	kg	7.70x10 ⁻²
1"+1" Interior Panel	kg	7.84x10 ⁻²
Output materials resulting from on-site waste processing (specified by route)		
5/8" Interior Panel	kg	0
1" Interior Panel	kg	0
1.5" Interior Panel	kg	0
1"+1" Interior Panel	kg	0
Mass of packaging waste specified by type		
Recycle	kg	0.00
Landfill		
5/8" Interior Panel	kg	6.35x10 ⁻²
1" Interior Panel	kg	0.102
1.5" Interior Panel	kg	0.153
1"+1" Interior Panel	kg	0.153
Incineration	kg	0
Biogenic carbon contained in packaging		
5/8" Interior Panel	kg CO ₂	1.98x10 ⁻²
1" Interior Panel	kg CO ₂	3.10x10 ⁻²
1.5" Interior Panel	kg CO ₂	4.65x10 ⁻²
1"+1" Interior Panel	kg CO ₂	4.65x10 ⁻²
Direct emissions to ambient air, soil and water	kg	0.00
VOC emissions	µg/m ³	0.00

4.6 PRODUCT USE

This study includes impacts associated with use phase scenarios. Module B1 is assumed to have no impacts. Module B2 includes the maintenance of the product, which is not required as specified by the manufacturer. Module B2 is then assumed to have no impacts. Module B3 includes the impacts associated with the repair of the product. No repairs of the product are required, as indicated by the manufacturer. The Reference Service Life (RSL) of the product is 30 years. During the Estimated Service Life (ESL) of 75 years the product will have to be replaced 1.5 times, the impacts of which are captured in Module B4. Modules B5 through B7 are assumed to have no impacts.

4.7 END-OF-LIFE

Impacts for deconstruction and dismantling processes (Module C1) were not applicable to this study as it is a manual process with hand tools and does not require energy for the removal of the product. Transport of the waste material at end-of-life is assumed to be 32 km. Module C3 (Waste Processing) is not applicable to this study as the end-of-life disposal is assumed to be 100% landfilled. Module C4 is included and represents the typical disposal of Cardinal Acoustics products. Table 12 summarizes the relevant information for the end-of-life of Cardinal Acoustics products within the system boundaries.

Table 12. End-of-Life summary for Cardinal Acoustics panels in this study, per 0.093 m².

End-of-life		Unit	Cardinal Acoustics 5/8" Interior Panel	Cardinal Acoustics 1" Interior Panel	Cardinal Acoustics 1.5" Interior Panel	Cardinal Acoustics 1"+1" Interior Panel
Collection process	Collected separately	kg	0.00	0.00	0.00	0.00
	Collected with mixed construction waste	kg	0.699	0.993	1.54	1.57
Recovery	Reuse	kg	0.00	0.00	0.00	0.00
	Recycling	kg	0.00	0.00	0.00	0.00
	Incineration	kg	0.00	0.00	0.00	0.00
	Incineration with energy recovery	kg	0.00	0.00	0.00	0.00
	Energy conversion (efficiency rate)	kg	0.00	0.00	0.00	0.00
Disposal	Landfill for final disposal	kg	0.699	0.993	1.54	1.57
Removals of biogenic carbon (excluding packaging)		kg	0.00	0.00	0.00	0.00

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The following environmental impact category indicators are reported using characterization factors based on TRACI 2.2 characterization methodology. These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits and are reported for 0.093 m² of installed panel with a reference service life (RSL) of 30 years.

TRACI 2.2 Impact Category	Unit
Global Warming Potential (GWP) - 100, IPCC 2015 AR6	kg CO ₂ eq
Eutrophication Potential Freshwater (EP-Fresh)	kg P eq
Eutrophication Potential Marine (EP-Marine)	kg N eq
Acidification Potential (AP)	kg SO ₂ eq
Smog Formation Potential (SFP)	kg O ₃ eq
Ozone Depletion Potential (ODP)	kg CFC-11 eq

5.1 Cardinal Acoustics Interior Acoustic Panel Results

Table 13. TRACI 2.2 Environmental Impact Results for Cardinal Acoustics 5/8" Interior Panels, per 0.093 m² of installed panel.

Module	Global Warming Potential	Eutrophication Potential Fresh	Eutrophication Potential Marine	Acidification Potential	Smog Formation Potential	Ozone Depletion Potential
	kg CO ₂ eq	kg N eq	kg N eq	kg SO ₂ eq	kg O ₃ eq	MJ, LHV
A1	0.283	1.10×10 ⁻⁴	5.50×10 ⁻⁴	1.32×10 ⁻³	1.29×10 ⁻²	1.97×10 ⁻⁹
A2	1.63×10 ⁻³	1.70×10 ⁻⁷	6.42×10 ⁻⁶	6.35×10 ⁻⁶	1.60×10 ⁻⁴	2.37×10 ⁻¹¹
A3	2.23×10 ⁻²	6.82×10 ⁻⁶	3.59×10 ⁻⁵	6.36×10 ⁻⁵	8.40×10 ⁻⁴	3.21×10 ⁻¹⁰
A1-A3 Total:	0.307	1.17×10⁻⁴	5.92×10⁻⁴	1.39×10⁻³	1.40×10⁻²	2.32×10⁻⁹
A4	2.27×10 ⁻²	2.36×10 ⁻⁶	8.93×10 ⁻⁵	8.83×10 ⁻⁵	2.18×10 ⁻³	3.30×10 ⁻¹⁰
A5	8.46×10 ⁻⁵	7.32×10 ⁻⁹	5.03×10 ⁻⁷	4.42×10 ⁻⁷	1.23×10 ⁻⁵	1.24×10 ⁻¹²
B1	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.495	1.79×10 ⁻⁴	1.03×10 ⁻³	2.22×10 ⁻³	2.43×10 ⁻²	3.99×10 ⁻⁹
B5	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00
C2	4.10×10 ⁻⁴	4.30×10 ⁻⁸	1.62×10 ⁻⁶	1.61×10 ⁻⁶	3.96×10 ⁻⁵	6.00×10 ⁻¹²
C3	0.00	0.00	0.00	0.00	0.00	0.00
C4	1.90×10 ⁻⁴	8.83×10 ⁻⁹	1.92×10 ⁻⁶	1.51×10 ⁻⁶	4.69×10 ⁻⁵	2.78×10 ⁻¹²

Table 14. TRACI 2.2 Environmental Impact Results for Cardinal Acoustics 1" Interior Panels, per 0.093 m² of installed panel.

Module	Global Warming Potential	Eutrophication Potential Fresh	Eutrophication Potential Marine	Acidification Potential	Smog Formation Potential	Ozone Depletion Potential
	kg CO2 eq	kg N eq	kg N eq	kg SO2 eq	kg O3 eq	MJ, LHV
A1	0.393	1.50×10 ⁻⁴	7.80×10 ⁻⁴	1.85×10 ⁻³	1.81×10 ⁻²	2.77×10 ⁻⁹
A2	2.30×10 ⁻³	2.40×10 ⁻⁷	9.05×10 ⁻⁶	8.95×10 ⁻⁶	2.20×10 ⁻⁴	3.35×10 ⁻¹¹
A3	3.33×10 ⁻²	1.01×10 ⁻⁵	5.49×10 ⁻⁵	9.68×10 ⁻⁵	1.29×10 ⁻³	4.98×10 ⁻¹⁰
A1-A3 Total:	0.429	1.60×10⁻⁴	8.44×10⁻⁴	1.96×10⁻³	1.96×10⁻²	3.30×10⁻⁹
A4	3.26×10 ⁻²	3.40×10 ⁻⁶	1.30×10 ⁻⁴	1.30×10 ⁻⁴	3.13×10 ⁻³	4.74×10 ⁻¹⁰
A5	1.30×10 ⁻⁴	1.12×10 ⁻⁸	7.63×10 ⁻⁷	6.72×10 ⁻⁷	1.87×10 ⁻⁵	1.90×10 ⁻¹²
B1	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.694	2.46×10 ⁻⁴	1.47×10 ⁻³	3.14×10 ⁻³	3.43×10 ⁻²	5.68×10 ⁻⁹
B5	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00
C2	5.90×10 ⁻⁴	6.11×10 ⁻⁸	2.31×10 ⁻⁶	2.28×10 ⁻⁶	5.63×10 ⁻⁵	8.53×10 ⁻¹²
C3	0.00	0.00	0.00	0.00	0.00	0.00
C4	2.60×10 ⁻⁴	1.26×10 ⁻⁸	2.73×10 ⁻⁶	2.15×10 ⁻⁶	6.68×10 ⁻⁵	3.96×10 ⁻¹²

Table 15. TRACI 2.2 Environmental Impact Results for Cardinal Acoustics 1.5" Interior Panels, per 0.093 m² of installed panel.

Module	Global Warming Potential	Eutrophication Potential Fresh	Eutrophication Potential Marine	Acidification Potential	Smog Formation Potential	Ozone Depletion Potential
	kg CO2 eq	kg N eq	kg N eq	kg SO2 eq	kg O3 eq	MJ, LHV
A1	0.608	2.30×10 ⁻⁴	1.20×10 ⁻³	2.87×10 ⁻³	2.80×10 ⁻²	4.28×10 ⁻⁹
A2	3.56×10 ⁻³	3.71×10 ⁻⁷	1.40×10 ⁻⁵	1.39×10 ⁻⁵	3.40×10 ⁻⁴	5.18×10 ⁻¹¹
A3	5.06×10 ⁻²	1.54×10 ⁻⁵	8.31×10 ⁻⁵	1.50×10 ⁻⁴	1.95×10 ⁻³	7.50×10 ⁻¹⁰
A1-A3 Total:	0.663	2.46×10⁻⁴	1.30×10⁻³	3.03×10⁻³	3.03×10⁻²	5.08×10⁻⁹
A4	5.04×10 ⁻²	5.25×10 ⁻⁶	2.00×10 ⁻⁴	2.00×10 ⁻⁴	4.84×10 ⁻³	7.33×10 ⁻¹⁰
A5	2.00×10 ⁻⁴	1.71×10 ⁻⁸	1.17×10 ⁻⁶	1.03×10 ⁻⁶	2.86×10 ⁻⁵	2.90×10 ⁻¹²
B1	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00
B4	1.07	3.77×10 ⁻⁴	2.26×10 ⁻³	4.86×10 ⁻³	5.31×10 ⁻²	8.75×10 ⁻⁹
B5	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00
C2	9.10×10 ⁻⁴	9.48×10 ⁻⁸	3.58×10 ⁻⁶	3.54×10 ⁻⁶	8.73×10 ⁻⁵	1.32×10 ⁻¹¹
C3	0.00	0.00	0.00	0.00	0.00	0.00
C4	4.10×10 ⁻⁴	1.95×10 ⁻⁸	4.23×10 ⁻⁶	3.34×10 ⁻⁶	1.00×10 ⁻⁴	6.15×10 ⁻¹²

Table 16. TRACI 2.2 Environmental Impact Results for Cardinal Acoustics 1"+1" Complete Interior Panels, per 0.093 m² of installed panel.

Module	Global Warming Potential	Eutrophication Potential Fresh	Eutrophication Potential Marine	Acidification Potential	Smog Formation Potential	Ozone Depletion Potential
	kg CO ₂ eq	kg N eq	kg N eq	kg SO ₂ eq	kg O ₃ eq	MJ, LHV
A1	0.778	2.80×10 ⁻⁴	1.61×10 ⁻³	3.60×10 ⁻³	3.69×10 ⁻²	4.08×10 ⁻⁷
A2	3.91×10 ⁻³	4.08×10 ⁻⁷	1.54×10 ⁻⁵	1.52×10 ⁻⁵	3.80×10 ⁻⁴	5.69×10 ⁻¹¹
A3	5.11×10 ⁻²	1.55×10 ⁻⁵	8.36×10 ⁻⁵	1.50×10 ⁻⁴	1.96×10 ⁻³	7.51×10 ⁻¹⁰
A1-A3 Total:	0.833	2.96×10⁻⁴	1.71×10⁻³	3.77×10⁻³	3.92×10⁻²	4.09×10⁻⁷
A4	5.12×10 ⁻²	5.34×10 ⁻⁶	2.00×10 ⁻⁴	2.00×10 ⁻⁴	4.92×10 ⁻³	7.45×10 ⁻¹⁰
A5	2.00×10 ⁻⁴	1.72×10 ⁻⁸	1.17×10 ⁻⁶	1.03×10 ⁻⁶	2.87×10 ⁻⁵	2.91×10 ⁻¹²
B1	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00
B4	1.33	4.52×10 ⁻⁴	2.88×10 ⁻³	5.96×10 ⁻³	6.66×10 ⁻²	6.15×10 ⁻⁷
B5	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00
C2	9.30×10 ⁻⁴	9.65×10 ⁻⁸	3.64×10 ⁻⁶	3.60×10 ⁻⁶	8.89×10 ⁻⁵	1.35×10 ⁻¹¹
C3	0.00	0.00	0.00	0.00	0.00	0.00
C4	4.20×10 ⁻⁴	1.98×10 ⁻⁸	4.31×10 ⁻⁶	3.39×10 ⁻⁶	1.10×10 ⁻⁴	6.26×10 ⁻¹²

The table below summarizes the nomenclature and reporting units for the additional inventory parameters (resource energy and waste flows), as specified in the PCR. Tables 17 through 20 present the results for the resource parameters listed below while Tables 21 through 24 present those categorized under the waste parameters.

Parameter	Units
Resources	
Renewable primary resources used as energy carrier (RPR _E)	MJ, LHV
Renewable primary resources used as material (RPR _M)	MJ, LHV
Non-renewable primary resources used as an energy carrier (NRPR _E)	MJ, LHV
Non-renewable primary resources used as material (NRPR _M)	MJ, LHV
Secondary materials (SM)	kg
Renewable secondary fuels (RSF)	MJ, LHV
Non-renewable secondary fuels (NRSF)	MJ, LHV
Recovered energy (RE)	MJ, LHV
Use of net freshwater resources (FW)	m ³
Wastes	
Non-hazardous waste disposed (NHWD)	kg
Hazardous waste disposed (NWD)	kg
High-level radioactive waste (HLRW)	kg
Intermediate- and low-level radioactive waste (ILLRW)	kg
Components for re-use (CRU)	kg
Materials for recycling (MR)	kg
Materials for energy recovery (MER)	kg
Recovered energy exported from the product system (EE)	MJ

Table 17. Resource use indicator results for Cardinal Acoustics 5/8" Interior Panels, per 0.093 m² of installed panel.

Module	RPR _E	RPR _M	NRPR _E	NRPR _M	SM	RSF	NRSF	RE	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	MJ	m ³
A1	1.27	3.20	2.31	0.00	0.00	0.00	0.00	0.00	6.46×10 ⁻²
A2	6.12×10 ⁻⁴	0.00	2.29×10 ⁻²	0.00	0.00	0.00	0.00	0.00	1.20×10 ⁻⁴
A3	0.101	0.00	0.374	0.00	0.00	0.00	0.00	0.00	4.14×10 ⁻³
A1-A3 Total:	1.37	3.20	2.71	0.00	0.00	0.00	0.00	0.00	6.89×10⁻²
A4	4.45×10 ⁻³	0.00	0.318	0.00	0.00	0.00	0.00	0.00	1.70×10 ⁻³
A5	1.44×10 ⁻⁵	0.160	1.15×10 ⁻³	0.00	0.00	0.00	0.00	0.00	5.29×10 ⁻⁶
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	2.06	5.04	4.56	0.00	0.00	0.00	0.00	0.00	0.106
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	8.10×10 ⁻⁵	0.00	5.79×10 ⁻³	0.00	0.00	0.00	0.00	0.00	3.10×10 ⁻⁵
C3	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
C4	2.13×10 ⁻⁵	0.00	2.38×10 ⁻³	0.00	0.00	0.00	0.00	0.00	6.47×10 ⁻⁶

Table 18. Resource use indicator results for Cardinal Acoustics 1" Interior Panels, per 0.093 m² of installed panel.

Module	RPR _E	RPR _M	NRPR _E	NRPR _M	SM	RSF	NRSF	RE	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	MJ	m ³
A1	1.79	4.54	3.23	0.00	0.00	0.00	0.00	0.00	9.10×10 ⁻²
A2	8.60×10 ⁻⁴	0.00	3.23×10 ⁻²	0.00	0.00	0.00	0.00	0.00	1.70×10 ⁻⁴
A3	0.164	0.00	0.565	0.00	0.00	0.00	0.00	0.00	6.33×10 ⁻³
A1-A3 Total:	1.96	4.54	3.83	0.00	0.00	0.00	0.00	0.00	9.75×10⁻²
A4	6.40×10 ⁻³	0.00	0.457	0.00	0.00	0.00	0.00	0.00	2.45×10 ⁻³
A5	2.21×10 ⁻⁵	0.227	1.77×10 ⁻³	0.00	0.00	0.00	0.00	0.00	8.11×10 ⁻⁶
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	2.94	7.16	6.45	0.00	0.00	0.00	0.00	0.00	0.150
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40×10 ⁻⁵
C2	1.15×10 ⁻⁴	0	8.22×10 ⁻³	0.00	0.00	0.00	0.00	0.00	0.00
C3	0	0	0	0.00	0.00	0.00	0.00	0.00	9.19×10 ⁻⁶
C4	3.03×10 ⁻⁵	3.2	3.38×10 ⁻³	0.00	0.00	0.00	0.00	0.00	6.47×10 ⁻⁶

Table 19. Resource use indicator results for Cardinal Acoustics 1.5" Interior Panels, per 0.093 m² of installed panel.

Module	RPR _E	RPR _M	NRPR _E	NRPR _M	SM	RSF	NRSF	RE	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	MJ	m ³
A1	2.77	7.02	5.01	0.00	0.00	0.00	0.00	0.00	0.141
A2	1.34×10 ⁻³	0.00	5.00×10 ⁻²	0.00	0.00	0.00	0.00	0.00	2.70×10 ⁻⁴
A3	0.246	0.00	0.857	0.00	0.00	0.00	0.00	0.00	9.58×10 ⁻³
A1-A3 Total:	3.02	7.02	5.91	0.00	0.00	0.00	0.00	0.00	0.151
A4	9.88×10 ⁻³	0.00	0.707	0.00	0.00	0.00	0.00	0.00	3.78×10 ⁻³
A5	3.37×10 ⁻⁵	0.351	2.70×10 ⁻³	0.00	0.00	0.00	0.00	0.00	1.23×10 ⁻⁵
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	4.54	11.1	9.96	0.00	0.00	0.00	0.00	0.00	0.232
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.78×10 ⁻⁴	0.00	1.28×10 ⁻²	0.00	0.00	0.00	0.00	0.00	6.83×10 ⁻⁵
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	4.70×10 ⁻⁵	0.00	5.26×10 ⁻³	0.00	0.00	0.00	0.00	0.00	1.43×10 ⁻⁵

Table 20. Resource use indicator results for Cardinal Acoustics 1"+1" Complete Interior Panels, per 0.093 m² of installed panel.

Module	RPR _E	RPR _M	NRPR _E	NRPR _M	SM	RSF	NRSF	RE	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	MJ	m ³
A1	2.77	7.02	4.36	0.643	0.00	0.00	0.00	0.00	0.141
A2	1.34×10 ⁻³	0.00	5.00×10 ⁻²	0.00	0.00	0.00	0.00	0.00	2.70×10 ⁻⁴
A3	0.246	0.00	0.857	0.00	0.00	0.00	0.00	0.00	9.58×10 ⁻³
A1-A3 Total:	3.02	7.02	5.27	0.643	0.00	0.00	0.00	0.00	0.151
A4	9.88×10 ⁻³	0.00	0.707	0.00	0.00	0.00	0.00	0.00	3.78×10 ⁻³
A5	3.37×10 ⁻⁵	0.351	2.70×10 ⁻³	3.21×10 ⁻²	0.00	0.00	0.00	0.00	1.23×10 ⁻⁵
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	4.54	11.1	7.98	1.01	0.00	0.00	0.00	0.00	0.232
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.78×10 ⁻⁴	0.00	1.28×10 ⁻²	0.00	0.00	0.00	0.00	0.00	6.83×10 ⁻⁵
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	4.70×10 ⁻⁵	0.00	5.26×10 ⁻³	0.00	0.00	0.00	0.00	0.00	1.43×10 ⁻⁵

Table 21. Waste and output indicator results for Cardinal Acoustics 5/8" Interior Panels, per 0.093 m² of installed panel.

Module	HWD	NHWD	HLRW	ILLRW	CRU	MFR	MER	EEE	EET
	kg	kg	kg	kg	kg	kg	kg	MJ Surplus	MJ Surplus
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.371	0.00	0.00	0.00	0.167	0.00	0.00	0.00
A1-A3 Total:	0.00	0.371	0.00	0.00	0.00	0.167	0.00	0.00	0.00
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A5	0.00	9.80×10 ⁻²	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.00	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	0.699	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 22. Waste and output indicator results for Cardinal Acoustics 1" Interior Panels, per 0.093 m² of installed panel.

Module	HWD	NHWD	HLRW	ILLRW	CRU	MFR	MER	EEE	EET
	kg	kg	kg	kg	kg	kg	kg	MJ Surplus	MJ Surplus
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.523	0.00	0.00	0.00	0.236	0.00	0.00	0.00
A1-A3 Total:	0.00	0.523	0.00	0.00	0.00	0.236	0.00	0.00	0.00
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A5	0.00	0.152	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	0.993	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 23. Waste and output indicator results for Cardinal Acoustics 1.5" Interior Panels, per 0.093 m² of installed panel.

Module	HWD	NHWD	HLRW	ILLRW	CRU	MFR	MER	EEE	EET
	kg	kg	kg	kg	kg	kg	kg	MJ Surplus	MJ Surplus
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.810	0.00	0.00	0.00	0.366	0.00	0.00	0.00
A1-A3 Total:	0.00	0.810	0.00	0.00	0.00	0.366	0.00	0.00	0.00
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A5	0.00	0.230	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.00	3.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 24. Waste and output indicator results for Cardinal Acoustics 1"+1" Complete Interior Panels, per 0.093 m² of installed panel.

Module	HWD	NHWD	HLRW	ILLRW	CRU	MFR	MER	EEE	EET
	kg	kg	kg	kg	kg	kg	kg	MJ Surplus	MJ Surplus
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.825	0.00	0.00	0.00	0.372	0.00	0.00	0.00
A1-A3 Total:	0.00	0.825	0.00	0.00	0.00	0.372	0.00	0.00	0.00
A4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A5	0.00	0.232	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.00	3.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00

6. LCA: Interpretation

Excluding Module B4 which represents the replacement of the product over a building's lifetime, the impact profile of the Cardinal Acoustics products is driven primarily by Module A1 (raw material acquisition). Module A1 accounts for approximately 86% of total Global Warming Potential (GWP) and 92% of Eutrophication Potential of Freshwater (EP-Fresh) on average for all products. Magnesium oxide and silicon dioxide are the two highest contributing single raw materials to the impact of Module A1.

7. Additional Environmental Information

7.1 MATERIAL SAFETY DATA SHEET

The Material Safety Data Sheet (MSDS) for Cardinal Acoustics panels can be found at the following link: <https://www.cardinalacoustics.com/resources/technical-sustainability>

7.2 ENVIRONMENT AND HEALTH DURING INSTALLATION

Please see the aforementioned Material Safety Data Sheet.

7.3 ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS

Cardinal Acoustics tiles and panels have also received the following environmental building credits and codes:

- Forese Stewardship Council (FSC) Certification
 - Cardinal Acoustics uses FSC-certified wood fiber, ensuring materials are sourced from responsibility managed forests with environmental, social and economic benefits
- LEED Contribution ((U.S. Green Building Council))
 - Cardinal Acoustics products contribute to several LEED v4/v4.1 credit categories, including:
 - Material and Resource Credit (MR) for
 - Building Product Disclosure - Sourcing of Raw Materials
 - Building Product Disclosure and Optimization - Material Ingredients
 - Indoor Environmental Quality (EQ) for
 - Low-Emitting Materials
 - Low Impact Cleaning and Maintenance Equipment Policy
 - Acoustic Performance

7.5 FURTHER INFORMATION

Further information about these products can be found on the company website: www.cardinalacoustics.com

8. References

- Life Cycle Assessment of Cardinal Acoustics Products. SCS Consulting Services Report. Prepared for Cardinal Acoustics. March 2026.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 14040: 2006/Amd1:2020 - Environmental Management – Life cycle assessment – Principles and Framework
- ISO 14044: 2006 Amd1 2017/Amd2 2020 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
- SCS Type III Environmental Declaration Program: Program Operator Manual. V12.0 December 2023. SCS Global Services.
- UL Product Category Rule (PCR) Guidance for Building-Related Products and Service, Part A: Life Cycle Assessment Calculation Rule and Report Requirements. Version 4.0. March 2022.
- UL Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part B: Non-Metal Ceiling and Interior Wall Panel System EPD Requirements. Version 2.0. April 13, 2021.
- OpenLCA 2.4.0, GreenDelta, 2024. <https://www.openlca.org/releases/>
- Ecoinvent Centre (2024) ecoinvent data from v3.11. Swiss Center for Life Cycle Inventories, Dübendorf, 2024. <http://www.ecoinvent.org>
- Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). Dr. Bare, J., <http://www.epa.gov/nrmrl/std/traci/traci.html>
- WARM Model Transportation Research – Draft.” Memorandum from ICF Consulting to United States Environmental Protection Agency. September 7, 2004. <http://epa.gov/epawaste/conservation/tools/warm/SWMGHGreport.html#background>.
- EPA Clean Energy Resource eGRID2024, January 17th 2025. <https://www.epa.gov/cleanenergy/energy-resources/egrid>

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