

Ultima® Ceiling Panels

High Performance Mineral Fiber

Ultima® Lay-In and Tegular Including
Low Embodied Carbon Panels

Committed to Sustainability

Armstrong World Industries leads in delivering solutions that meet today's most stringent industry sustainability standards. We are committed to environmental responsibility in all aspects of our business, and carbon reduction is part of our 2030 Company goals and ambitions.

We were one of the first companies to create and publish the Environmental Product Declaration (EPD) in the ceiling industry. We have over a decade of experience using Life Cycle Assessment (LCA) to evaluate environmental impacts of our products starting with design, to raw materials, and through our operations. We are constantly working to optimize our operations and products to reduce their environmental impact. We believe the use of LCA and our commitment to transparency of our products' carbon footprint is critical to contributing to decarbonization of the built environment.

Contents:

- Performance features like acoustics, light reflectance, and durability
- Product application and use
- Product ingredients and their sources
- How the product is produced
- LCA results, including global warming potential and primary energy usage
- Total impacts over the product life cycle

For more information visit

armstrongceilings.com/transparency

Life Cycle Impact Categories (A1-A3) for 1 ft²

Cradle-to-Gate environmental impacts for 1 ft² of Ultima® Low Embodied Carbon ceiling panels



Embodied Carbon (GWP)

1.87E-01 kg CO₂ eq.



Acidification Potential

9.46E-03 kg SO₂ eq.



Photochem Ozone Creation Potential

1.97E-02 kg O₃ eq.



Eutrophication Potential

2.93E-04 kg N eq.



Ozone Depletion Potential

6.91E-09 kg CFC 11 eq.



Primary Energy

6.45E+00 MJ, LHV



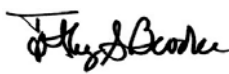

Ultima® on Suprafine® XL® Suspension System



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1. CONTENT OF THE EPD

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	ASTM International – 100 Barr Harbor Drive, West Conshohocken, PA, 19428, USA
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs), General Program Instructions, Version: 8.0, Revised 04/29/20
MANUFACTURER NAME AND ADDRESS	Armstrong World Industries 2500 Columbia Avenue Lancaster, PA 17603
DECLARATION NUMBER	EPD 591
DECLARED PRODUCT & DECLARED UNIT	0.093m ² (1ft ²) of installed ceiling panel, with a product reference service life (RSL) of 30 years.
REFERENCE PCR AND VERSION NUMBER	UL Environment PCR for Building-Related Products & Services – Part A (Dec. 2018, v.3.2), UL Environment PCR Part B: Non-Metal Ceiling Panel & Wall Panel System (April 2021, v.2.0)
DESCRIPTION OF PRODUCT'S INTENDED APPLICATION AND USE (AS IDENTIFIED WHEN DETERMINING PRODUCT RSL)	Ultima® Lay-In and Tegalur Ceiling Panels including Ultima® Low Embodied Carbon Ceiling Panels
PRODUCT RSL DESCRIPTION (IF APPL.)	30 Years
MARKETS OF APPLICABILITY	Commercial and Residential Interior Furnishing
DATE OF ISSUE	February 15, 2024
PERIOD OF VALIDITY	5 years
EPD TYPE	Product-Specific
DATASET VARIABILITY	Industry Average Only
EPD SCOPE	Cradle to Grave
YEAR(S) OF REPORTED MANUFACTURER PRIMARY DATA	2022
LCA SOFTWARE & VERSION NUMBER	GaBi 9 by Sphera Inc
LCI DATABASE(S) & VERSION NUMBER	GaBi Service Pack 39 by Sphera Inc
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1
The sub-category PCR review was conducted by:	EPD Review Panel Chair Lindita Bushi EPD@ul.com
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment “Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report,” serves as the core PCR.	 Tim Brooke, ASTM International
<input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL	
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Armstrong World Industries, Inc.
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Lindita Bushi, PhD Athena Sustainable Materials Institute lindita.bushi@athenaasmi.org 
LIMITATIONS	

Environmental declarations from different programs (ISO 14025) may not be comparable.

Comparison of the environmental performance of Metal Ceiling and Wall System Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR.

Full conformance with this PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences in results for upstream or downstream of the life cycle stages declared.

2. GENERAL INFORMATION

2.1 DESCRIPTION OF ORGANIZATION

Armstrong World Industries, Inc. (AWI) is a leader in the design and manufacture of innovative commercial and residential ceiling, wall and suspension system solutions in the Americas. At home, at work, in healthcare facilities, classrooms, stores, or restaurants, Armstrong World Industries offers interior solutions that help to enhance comfort, save time, improve building efficiency and overall performance, and create beautiful spaces.

2.2 PRODUCT DESCRIPTION

Ultima® Lay-in and Tegular Ceiling Panels including Low Embodied Carbon Panel which have been formulated with biochar, (UNSPSC Code 30161601 and CSI 09 51 00) a bio-based, 100% renewable alternative to increase product circularity. The life cycle assessment does not include hanger wires, molding, or attachment/hold down clips.

2.2.1 Product-Specific EPD

Ultima® ceiling panels are manufactured by Armstrong World Industries in Pensacola, Florida (32505) and Marietta, Pennsylvania (17547). Ultima Low Embodied Carbon Ceiling Panels are produced in Pensacola, FL.

2.2.2 Product Identification

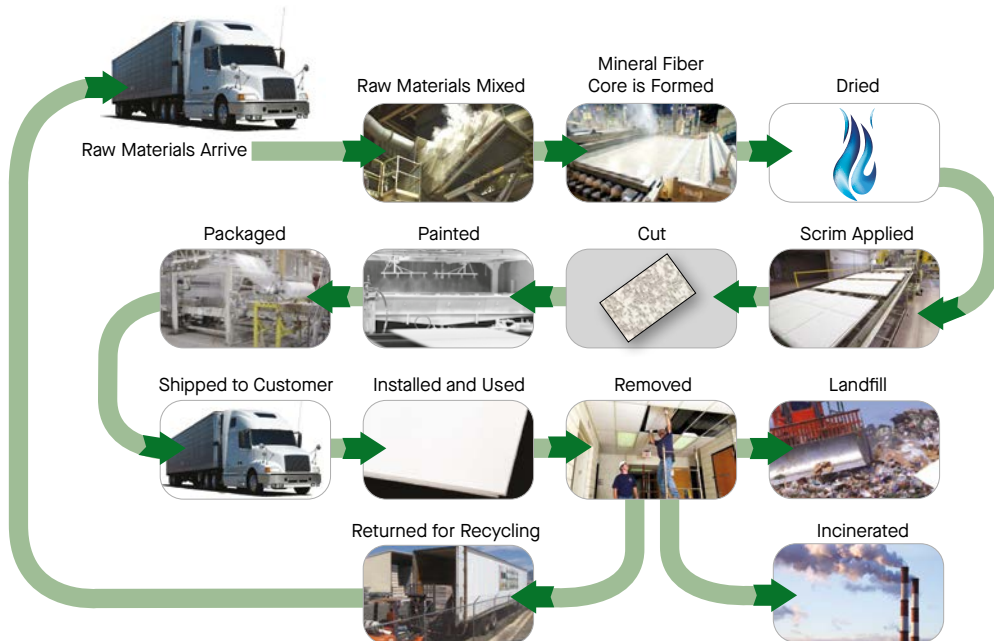
Ultima® smooth-textured mineral fiber panels are washable, impact- and scratch-resistant with a non-directional visual. They offer both Sustain® and Total Acoustics® panel performance for flexible spaces.

2.2.3 Product Specification

These products generally fall under ASTM E1264 Section 5.2 designation as Type III – Mineral base with painted finish.

2.2.4 Flow Diagram

Ultima® Lay-in and Tegular Ceiling Panels including Low Embodied Carbon Panels are made in a wet-formed process which is shown in the flow diagram below.



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2.3 PRODUCT AVERAGE

2.3.2 Product-Specific EPD

This EPD is specific to Ultima® Lay-in and Tegular Ceiling Panels and Ultima® Low Embodied Carbon Ceiling Panels. A weighted average approach was applied. Inputs were developed based on 2022 production volumes and weights for Ultima® products.

2.4 APPLICATION

The products covered by this EPD are designed to be installed in a suitable metal grid system.

2.5 MATERIAL COMPOSITION

Major raw materials used in ceiling panel manufacturing are summarized in the table below.

TABLE 1. MATERIAL COMPOSITION

Material	Ultima® Ceiling Panels	Ultima® Low Embodied Carbon Ceiling Panels
Mineral Wool	65-70%	45-50%
Perlite	15-20%	20-25%
Biochar	0%	10-15%
Corn Starch	5-10%	5-10%
Recycled Paper		5-10%

2.6 TECHNICAL REQUIREMENTS

TABLE 2. TECHNICAL DATA

Property	Test Method	Ultima® Ceiling Panels	Ultima® Low Embodied Carbon Ceiling Panels
Sound absorption coefficient (NRC)	ASTM C423	0.75	0.75
Interzone attenuation of open office components (AC)	ASTM E1111, ASTM E1110	-	-
Sound Transmission Class (STC)	ASTM E413, ASTM E90	-	-
Sound attenuation between rooms sharing a common ceiling plenum (CAC)	ASTM E1414, ASTM E413	35	35
Light reflectance	ASTM E1477	0.88	0.88
Flame spread/smoke development	ASTM E84, ASTM E1264	Class A	Class A

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The final EPD is available on the Armstrong website (armstrongceilings.com/epd); at UL SPOT (spot.ul.com) and is under the Finish category in the EC3 Tool (buildingtransparency.org).

3. METHODOLOGICAL FRAMEWORK

This study provides life cycle inventory and environmental impacts relevant to Armstrong® suspended ceilings. The LCA follows an attributional approach as outlined in ISO 21930 Section 7.1.1 – see also PCR Part A-6.

3.1 DECLARED UNIT

The declaration refers to the declared unit of 0.093 m² (1 ft²) of installed ceiling panel, as defined by the PCR.

3.2 FUNCTIONAL/DECLARED UNIT PROPERTIES

TABLE 3. FUNCTIONAL OR DECLARED UNIT PROPERTIES

Product	Declared Unit m ² (ft ²)	Declared Thickness cm (in)	Surface Weight kg/0.093 m ² (lb/ft ²)	Density kg/m ³ (lb/ft ³)
Ultima® Ceiling Panels	0.093 (1)	1.905 (0.75)	0.467 (1.05)	28.3 (16.8)
Ultima® Low Embodied Carbon Ceiling Panels	0.093 (1)	1.905 (0.75)	0.467 (1.05)	28.3 (16.8)

3.3 SYSTEM BOUNDARY

The scope of the study includes production, installation, and end of life. Production of capital equipment, facilities, and infrastructure required for manufacture are outside the scope of this assessment. Details of inclusions and exclusions from the system boundary are listed below.

TABLE 4. ELEMENTS INCLUDED IN THE CRADLE TO GATE WITH OPTIONS STUDY

Includes	Excludes
<ul style="list-style-type: none"> – Raw materials production (A1) – Inbound transport of raw materials to production facility (A2) – Manufacturing of panels (A3) – Electricity and fuel combustion (A3) – Packaging of final products (A3) – Transportation to the job site (A4) – Installation and installation waste (A5) – Deconstruction – manual, no impact (C1) – End of life, including transport (C2-C4) 	<ul style="list-style-type: none"> – Construction of capital equipment and other infrastructure flows – Maintenance and operation of support equipment – Human labor and employee transport – Manufacture and transport of packaging materials not associated with final product – Use Phase (B1 to B7) – Benefits and loads beyond the system boundary (D)

3.4 PRODUCT-SPECIFIC CALCULATIONS FOR END-OF-LIFE PHASE (MODULES C1-C4)

At this time, there is no industry consensus for product-specific assumption behind reported scenarios for information in modules C1-C4. Armstrong facilitates ceiling panels recycling through our Takeback program. The recovery data is based on internal averages for commingled ceiling panels that arrived at Armstrong factories from the construction and demolition site at end of product life. Remaining panels were assumed to be landfilled as per standard industry practice.

3.5 REFERENCE SERVICE LIFE AND ESTIMATED BUILDING SERVICE LIFE

In accordance with the PCR, the Reference Service Life (RSL) for this study was assumed to be 30 years.

3.6 ALLOCATION

Allocation at the manufacturing plant was based on production volume. Allocation of background data (energy and materials) taken from the GaBi databases.

3.7 CUT-OFF RULES

No known flows are deliberately excluded from this EPD. The system boundary was defined based on relevance to the goal of the study. For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

3.8 DATA SOURCES

Primary data for this study was collected from the manufacturing facility for 2022 and datasets for materials upstream from manufacturing were obtained from the GaBi database version 10.6.2.9

3.9 DATA QUALITY

The data quality ranges from good to very good. The temporal quality of the data is very good with both manufacturing-specific data and GaBi background data from 2022.2. Because primary and secondary data were collected specifically to the location of manufacture when possible, geographical representativeness is considered to be good.

3.10 PERIOD UNDER REVIEW

All the primary data in the scope of this analysis was collected from Armstrong manufacturing facilities during 2022.

3.11 COMPARABILITY AND BENCHMARKING

We do not have any data on comparable non-competitive products to report.

3.12 ESTIMATES AND ASSUMPTIONS

The datasets for materials upstream from manufacturing are from the GaBi database. When inventories were not available for materials, conservative proxy datasets were chosen based on similarity of material. Additionally and consistent with the PCR, the following assumptions in Table 5 related to transport, installation, and deconstruction procedures were made.

TABLE 5. TRANSPORT, INSTALLATION, AND DECONSTRUCTION PROCEDURES

Product transport from point of manufacture to building site	Mode: Diesel-powered truck/trailer Distance: 800 km
Product transport from building site to waste processing	Mode: Diesel-powered truck/trailer Distance: 35 km
Installation & deconstruction procedures	Manual (no operational energy use)

3.13 UNITS

Units commonly used in the North American market are included in addition to the required SI units.

4. TECHNICAL INFORMATION AND SCENARIOS

All data is reported as a North American weighted average across our ceiling plant locations. The majority of Armstrong® Ceiling products are distributed within 500 miles of the respective manufacturing plants. The same distribution trucks that take material to distribution centers backhaul post-consumer recycled ceiling panels to the manufacturing plants as part of our closed loop recycling program. If product is not recycled, disposal transportation at end of life is assumed to be 50 miles. Transportation emissions and fuels throughout the life cycle phases are included. All transportation associated with raw materials reflect the actual modes of transportation and mileage.

4.1 MANUFACTURING

The manufacturing process has been described in a simple flow chart in Section 2.2.4. When a product is manufactured at multiple locations, a volume-based averaging of the input parameters approach was used. Any manufacturing waste was reported in the primary data for this study.

4.2 PACKAGING

Armstrong® ceiling panels are well packaged in a variety of wooden panels, rigid corrugate, and stretch wrap. Stacks of material are banded to wooden pallets for shipping.

4.3 TRANSPORTATION

The following information specifies any transport after the manufacturing gate. Details of type of transport, type of vehicle, distance, type, and amount of energy carrier are listed. These values are consistent with industry standard assumptions.

TABLE 6. TRANSPORT TO THE BUILDING SITE (A4)

Material	Unit	Ultima® Ceiling Panels	Ultima® Low Embodied Carbon Ceiling Panels
Liters of fuel (Diesel)	L/100km/m ³	0.00314	0.00314
Transport distance	km	805	805
Capacity utilization (including empty runs)	%	67	67
Gross density of products transported	kg/m ³	28.3	28.3
Capacity utilization volume factor	-	1	1

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4.4 PRODUCT INSTALLATION

The ceiling system must be installed in accordance with Armstrong Ceilings installation guidelines. Our ceiling system installation brochure, “Installing Suspended Ceilings”, is a general application overview, covering essential steps of a basic suspended ceiling installation. You can reference this document at armstrongceilings.com/installationinstructions.

TABLE 7. INSTALLATION INTO THE BUILDING (A5)

Name	Ultima® Ceiling Panels	Ultima® Low Embodied Carbon Ceiling Panels	Unit
Ancillary materials	0	0	kg
Net freshwater consumption specified by water source and fate (X m3 river water evaporated, X m3 city water disposed to sewer)	0	0	m3
Other resources	0	0	kg
Electricity consumption	0	0	kWh
Other energy carriers	0	0	MJ
Product loss per declared unit	0.023	0.023	kg
Waste materials at the construction site before waste processing, generated by product installation	0.053	0.053	kg
Output materials resulting from on-site waste processing	0	0	kg
Mass of packaging waste specified by type	0	0	kg
Plastic	0.005	0.005	kg
Metal	0.000	0.000	kg
Cardboard	0.020	0.020	kg
Wood	0.005	0.005	kg
Biogenic carbon contained in packaging	0.014	0.014	kg CO2
Direct emissions to ambient air, soil and water	-	-	kg
VOC emissions	≤ 0.5	≤ 0.5	mg/m3

4.5 USE

A product’s RSL depends on the product properties and reference in-use conditions. The default RSL assumed in this PCR is 30 years for both ceiling and wall products.

4.6 DISPOSAL

End of Life

The end-of-life phase for the ceiling panels was included in the study. End-of-life impacts include landfill disposal of ceiling panels.

TABLE 8. END OF LIFE (C1-C4)

Name		Ultima® Ceiling Panels	Ultima® Low Embodied Carbon Ceiling Panels	Unit
Collection process (specified by type)	Collected separately	0	0	kg
	Collected with mixed construction waste	0	0	m3
Recovery (specified by type)	Reuse	0	0	kg
	Recycling	0.005	0.005	kWh
	Incineration	0	0	MJ
	Incineration with energy recovery	0	0	kg
	Energy conversion (specify efficiency rate)	0	0	kg
Disposal (specified by type)	Product or material for final disposal	0.462	0.462	kg
Removals of biogenic carbon (excluding packaging)		0	0	kg

4.7 REUSE PHASE

TABLE 9. REUSE, RECOVERY, AND/OR RECYCLING POTENTIALS (D), RELEVANT SCENARIO INFORMATION

Name	Value	Unit
Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6)	0	MJ
Net energy benefit from thermal energy due to treatment of waste declared as exported energy in C4 (R<0.6)	0	MJ
Net energy benefit from material flow declared in C3 for energy recovery	0	MJ
Process and conversion efficiencies	-	
Further assumptions for scenario development	-	

5. ENVIRONMENTAL INDICATORS DERIVED FROM LCA

5.1 LCA RESULTS FROM LCIA

The Life Cycle Assessment (LCA) was performed according to ISO 14040 guidelines and follows the specific PCR instructions. The cradle-to-gate with options LCA consists of raw material production, transport of raw materials to production facility prior to processing, manufacturing of ceiling and wall panels, packaging; transportation to job site and installation, and end of life including disposal or recycling to Armstrong factories.

(X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

TABLE 10. DESCRIPTION OF THE SYSTEM BOUNDARY MODULES*

	Production			Construction		Use							End Of Life				Benefits and Loads Beyond System Boundary	
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
EPD Type	Raw material supply	Transport	Manufacturing	Transport to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Deconstruction	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential	
						B6 Operational Energy Use of Building Integrated System During Product Use												
						B7 Operational Water Use of Building Integrated System During Product Use												
Cradle to Gate with Options	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND	

* Results for modules A1-A3 results are aggregated, as described in the PCR.

5.2 LCA RESULTS FROM LCIA

Life cycle impacts reported below are based on TRACI 2.1 methodology. Results are provided in reference to the declared unit. For the other impact categories, results are presented in the tables below using the ISO 21930 standard and for the declared unit. Because products include biobased content, they store or sequester carbon. Table 11 includes both Global Warming Potential (GWP) excluding biogenic and GWP including biogenic carbon. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. 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.

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TABLE 11. TRACI 2.1 IMPACT ASSESSMENT FOR 0.093 M² (1 FT²) OF ULTIMA® PANELS*

Ultima® Ceiling Panels								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO ₂ eq.	2.31E-01	3.27E-02	1.60E-01	6.77E-03	4.29E-02	1.54E-03	7.95E-02
GWP, including biogenic	kg CO ₂ eq.	1.34E-01	3.27E-02	1.60E-01	6.77E-03	4.05E-02	1.54E-03	1.13E-01
ODP	kg CFC 11 eq.	4.81E-09	8.02E-17	1.31E-10	1.76E-17	3.46E-10	4.00E-18	4.85E-16
AP	kg SO ₂ eq.	7.98E-03	3.78E-04	1.07E-03	1.90E-05	6.99E-04	4.26E-06	3.52E-04
EP	kg N eq.	2.32E-04	1.86E-05	1.68E-05	1.99E-06	2.65E-05	4.48E-07	4.64E-05
SFP	kg O ₃ eq.	6.69E-03	7.61E-03	4.17E-03	4.34E-04	1.62E-03	9.71E-05	1.83E-03
FFD	MJ Surplus	2.54E-01	5.95E-02	3.16E-01	1.27E-02	5.33E-02	2.89E-03	1.99E-02
Ultima® Low Embodied Carbon Ceiling Panels								
Parameter	Unit	A1	A2	A3	A4	A5	C2	C4
GWP, excluding biogenic	kg CO ₂ eq.	2.00E-01	4.08E-02	1.76E-01	6.77E-03	4.24E-02	1.54E-03	7.95E-02
GWP, including biogenic	kg CO ₂ eq.	-3.01E-02	4.08E-02	1.76E-01	6.77E-03	3.07E-02	1.54E-03	1.13E-01
ODP	kg CFC 11 eq.	6.78E-09	9.95E-17	1.31E-10	1.76E-17	4.83E-10	4.00E-18	4.85E-16
AP	kg SO ₂ eq.	7.91E-03	4.95E-04	1.06E-03	1.90E-05	7.00E-04	4.26E-06	3.52E-04
EP	kg N eq.	2.53E-04	2.37E-05	1.55E-05	1.99E-06	2.82E-05	4.48E-07	4.64E-05
SFP	kg O ₃ eq.	5.89E-03	9.91E-03	3.93E-03	4.34E-04	1.71E-03	9.71E-05	1.83E-03
FFD	MJ Surplus	2.09E-01	7.41E-02	3.59E-01	1.27E-02	5.42E-02	2.89E-03	1.99E-02

* Modules C1 and C3 are null.

The A1 to A3 GWP-100 Ultima Ceiling Panels resulted in 0.424 and 0.327 kg CO₂ eq, excluding and including biogenic CO₂, respectively. While the A1 to A3 GWP-100 Ultima Low Embodied Carbon Ceiling Panels resulted in 0.327 and 0.417 kg CO₂ eq, excluding and including biogenic CO₂, respectively.

5.3 LCA RESULTS FROM LCI

TABLE 12. LCA RESULTS - RESOURCE USE FOR 0.093 M² (1 FT²) OF ULTIMA® PANELS

Ultima® Ceiling Panels									
Parameter	Parameter ²	Unit	A1	A2	A3	A4	A5	C2	C4
RPre	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	8.44E-01	1.39E-02	2.87E-01	3.82E-03	9.75E-02	8.69E-04	1.85E-02
RPRm	Renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	3.45E+00	4.50E-01	3.14E+00	9.59E-02	5.69E-01	2.18E-02	1.58E-01
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ₃	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ₃	3.72E-03	4.62E-05	7.39E-04	1.31E-05	3.84E-04	2.98E-06	3.05E-05
Ultima® Low Embodied Carbon Ceiling Panels									
Parameter	Parameter ²	Unit	A1	A2	A3	A4	A5	C2	C4
RPre	Renewable primary resources used as energy carrier (fuel)	MJ, LHV	3.94E-01	1.68E-02	3.24E-01	3.82E-03	6.87E-02	8.69E-04	1.85E-02
RPRm	Renewable primary resources with energy content used as material	MJ, LHV	-2.68E+00	0.00E+00	0.00E+00	0.00E+00	-1.87E-01	0.00E+00	0.00E+00
NRPRE	Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	2.53E+00	5.60E-01	3.19E+00	9.59E-02	5.16E-01	2.18E-02	1.58E-01
NRPRM	Non-renewable primary resources with energy content used as material	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	Secondary materials	kg	-4.62E-06	0.00E+00	0.00E+00	0.00E+00	-3.24E-07	0.00E+00	0.00E+00
RSF	Renewable secondary fuels	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRDF	Non-renewable secondary fuels	m ₃	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	Recovered Energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	Use of net fresh water	m ₃	3.58E-03	5.58E-05	6.86E-04	1.31E-05	3.71E-04	2.98E-06	3.05E-05

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TABLE 13. LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES FOR 0.093 M² (1 FT²) OF ULTIMA® PANELS

Ultima® Ceiling Panels									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	kg	9.35E-07	1.27E-12	2.50E-10	2.76E-13	6.75E-08	6.28E-14	3.94E-12
NHWD	NHWD Non-hazardous waste disposed	kg	8.42E-03	3.43E-05	7.09E-02	8.35E-06	4.69E-02	1.90E-06	4.42E-01
RWD	Radioactive waste disposal	kg	2.90E-04	1.26E-06	2.29E-04	2.75E-07	3.82E-05	6.26E-08	1.75E-06
HLRW	High-level radioactive waste, conditioned, to final repository	kg	3.47E-07	1.50E-09	2.75E-07	3.26E-10	4.52E-08	7.42E-11	1.95E-09
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.90E-04	1.26E-06	2.29E-04	2.75E-07	3.81E-05	6.25E-08	1.75E-06
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Recovered energy exported from the product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ultima® Low Embodied Carbon Ceiling Panels									
Parameter	Description	Unit	A1	A2	A3	A4	A5	C2	C4
HWD	Hazardous waste disposed	kg	9.35E-07	1.58E-12	3.03E-10	2.76E-13	6.75E-08	6.28E-14	3.94E-12
NHWD	NHWD Non-hazardous waste disposed	kg	6.74E-03	4.22E-05	1.02E-01	8.35E-06	4.90E-02	1.90E-06	4.42E-01
RWD	Radioactive waste disposal	kg	2.12E-04	1.57E-06	1.56E-04	2.75E-07	2.76E-05	6.26E-08	1.75E-06
HLRW	High-level radioactive waste, conditioned, to final repository	kg	2.53E-07	1.86E-09	1.87E-07	3.26E-10	3.25E-08	7.42E-11	1.95E-09
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.12E-04	1.56E-06	1.56E-04	2.75E-07	2.76E-05	6.25E-08	1.75E-06
CRU	Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	Recovered energy exported from the product system	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Ultima® Ceiling Panels

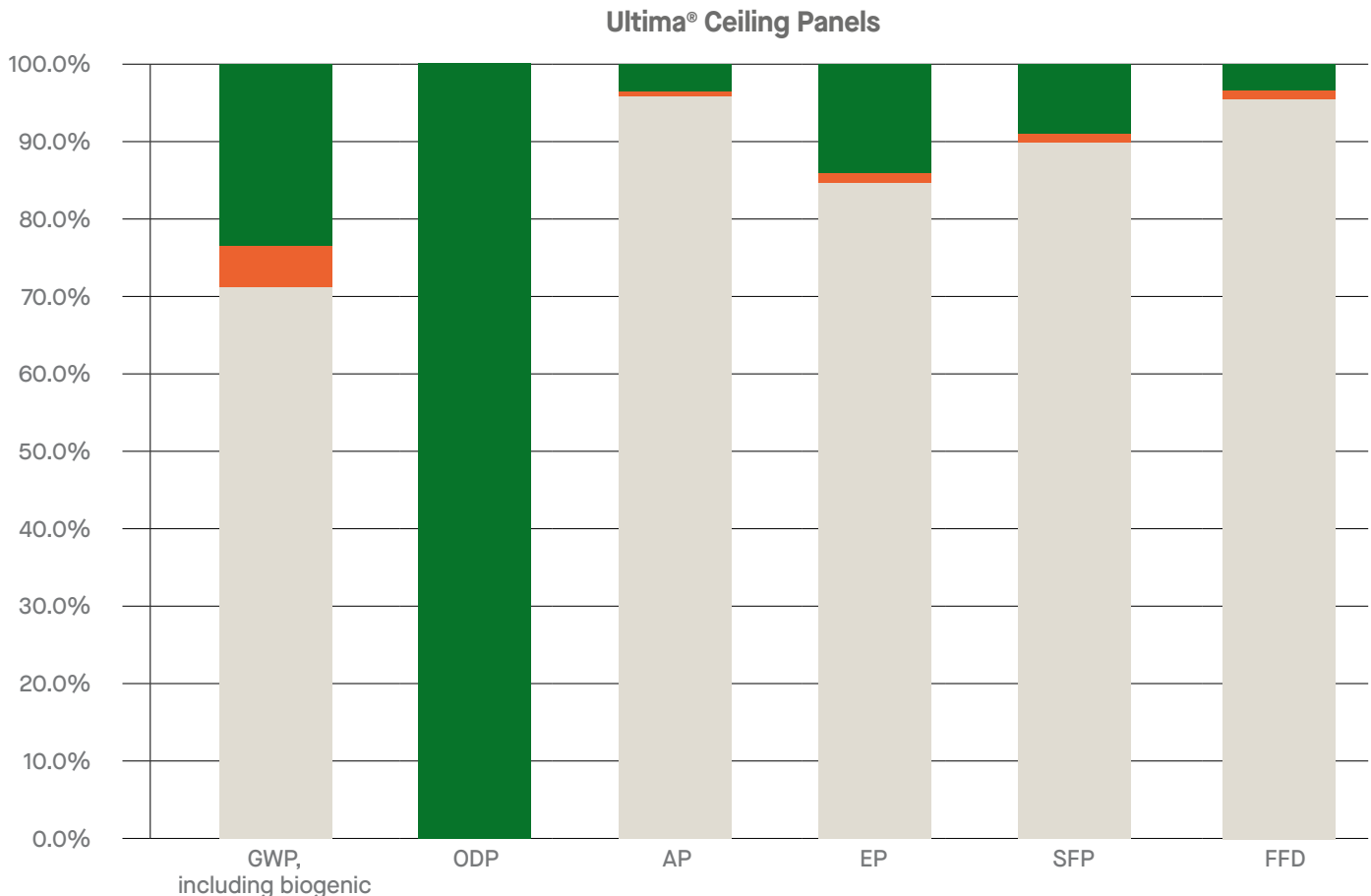
High Performance Mineral Fiber

TABLE 14. CARBON EMISSIONS AND REMOVALS PER 0.093 M² (1 FT²) OF ULTIMA® PANELS

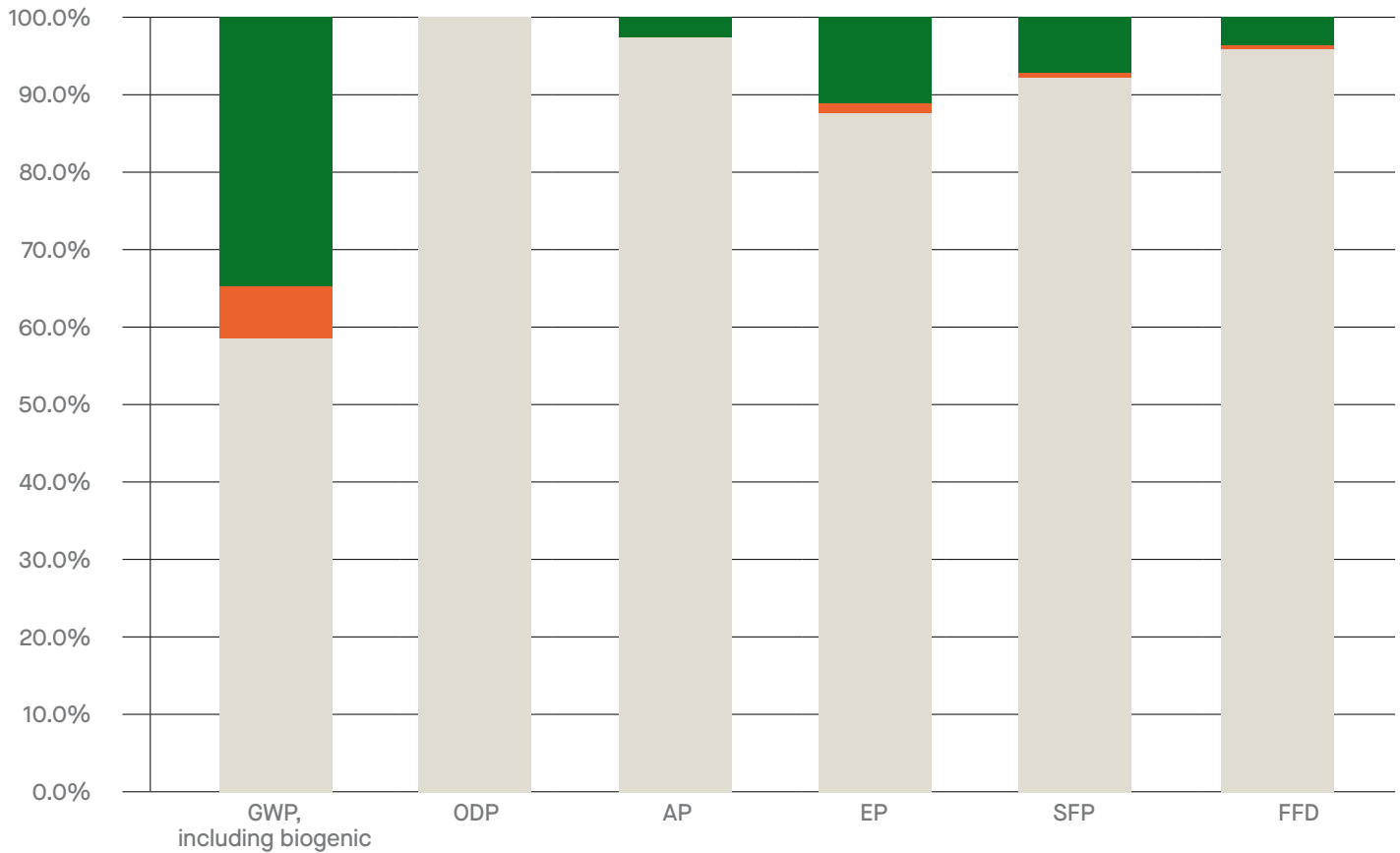
Parameter	Description	Unit	Ultima® Ceiling Panels	Ultima® Low Embodied Carbon Ceiling Panels
BCRP	Biogenic Carbon Removal from Product	kg CO ₂	-0.0457	-0.1788
BCEP	Biogenic Carbon Emission from Product	kg CO ₂	0.0140	0.0141
BCRK	Biogenic Carbon Removal from Packaging	kg CO ₂	-0.0303	-0.0303
BCEK	Biogenic Carbon Emission from Packaging	kg CO ₂	0.0131	0.0131

6. LCA: INTERPRETATION

The ceiling life cycle covered in this study concluded that the ceiling panel manufacturing process and raw materials in the ceiling panel have the greatest impact on “carbon footprint” as represented by Global Warming Potential [GWP].



Ultima® Low Embodied Carbon Ceiling Panels



KEY

- Product (A1-A3)
- Construction (A4-A5)
- End of Life (C1-C4)

Life Cycle Impact Assessment of the ceiling panels¹ relative importance in percentage terms for the Production, Construction, and End-of-Life stages for the ceiling panel.

¹ Based on U.S. EPA TRACI 2.1 Impact Factors

7. ADDITIONAL ENVIRONMENTAL INFORMATION

7.1 ENVIRONMENT AND HEALTH DURING MANUFACTURING

Armstrong World Industries has a comprehensive environmental, health, and safety management program. Risk reduction begins in the product design process. All products go through a safety, health, and environmental review prior to sale. Armstrong also has a long-standing commitment to the safety and health of all our employees.

Armstrong World Industries is equally committed to reducing our environmental impact. As with safety goals, each manufacturing facility has environmental initiatives focused on responsible use of energy and water, and on waste reduction.

7.2 ENVIRONMENT AND HEALTH DURING INSTALLATION

All recommendations shall be utilized as indicated by SDS and installation guidelines. Specific product SDS and installation instructions can be downloaded at: armstrongceilings.com/pdbupimages-clg/217521.pdf

7.3 ENVIRONMENTAL ACTIVITIES AND CERTIFICATIONS

All environmental certifications can be found at: Armstrongceilings.com

7.4 FURTHER INFORMATION

Additional Information can be found at: armstrongceilings.com

8. PROJECT REPORT AND SUPPORTING DOCUMENTATION

This study provides life cycle inventory and environmental impacts relevant to Armstrong® suspended ceilings. This report is intended to fulfill the reporting requirements in Section 5 of ISO 14044 and Product Category Rules Guidance for Building-Related Products and Services UL® Environments (2021) Part B: Non-Metal Ceiling Panel EPD Requirements.

Armstrong World Industries has a robust internal Quality Assurance process that is based on industry-accepted best practices and is led by a team of quality professionals who have been certified by the American Society for Quality. The process involves several hundred different measures made throughout the manufacturing processes. In addition, our products are UL® labeled for fire and acoustical performance – a process which involves strict oversight by Underwriters Laboratories. The Armstrong Ceilings acoustical laboratory is ISO 17025 certified and is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

9. REFERENCES

ASTM International General Program instructions, v8.0, April 29, 2020.

ISO 14025:2006 – Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14040/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

Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers version 1.2, January 2017.

UL Product Category Rules for Building-Related Products and Services Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, UL 10010, v3.2 December 2018.

UL Product Category Rules for Building-Related Products and Services Part B: Non-Metal Ceiling Panel EPD Requirements, UL 10010-26, v2.0, 2021.